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ABSTRACT

The effect of Performance Based Teacher Education (PBTE) training on types of objectives teachers set for their classes, the students' perception of self-progress and their perception of classroom environment were evaluated and compared. Fifty-six science teachers and one class of students taught by each teacher participated in this study. Four instruments specifically designed for the study were used for analysis purposes. Within the limitations of the study, the results seem to indicate that the humanistic behaviors of science teachers are little influenced by their training program. Teachers trained in PBTE programs were found to be no more or no less humanistic than teachers lacking PBTE training. (Author/EB)

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A COMPARATIVE STUDY OF SOME HUMANISTIC BEHAVIORS OF SCIENCE TEACHERS TRAINED IN A PERFORMANCE BASED TEACHER EDUCATION PROGRAM AND THOSE TRAINED IN A NON-PERFORMANCE BASED PROGRAM

by

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DISSERTATION

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L. B. S.

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July 1974

A COMPARATIVE STUDY OF SOME HUMANISTIC BEHAVIORS OF SCIENCE TEACHERS TRAINED IN A PERFORMANCE BASED TEACHER EDUCATION PROGRAM AND THOSE TRAINED IN A NON-PERFORMANCE BASED PROGRAM

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The University of Texas at Austin, 1974

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The purpose of this investigation was to evaluate the effect of performance based teacher education (PBTE) training on selected humanistic behaviors of science teachers. Analysis of this effect was made using four instruments specifically designed for this study.

Additionally, the influence of eleven factors, other than PBTE, was studied and reported. These factors included: the school where certification was achieved, teacher's perception of the size of its student population and the number of science teachers it certified; the age and sex of the teacher, and the level and subjects which they taught; the amount of conferencing with instructors and the amount, if any, of human relations training they had received.

Fifty-six science teachers and one class of students taught by each teacher participated in the study. The teachers had been certified by six different universities or colleges in three states.

Seven null hypotheses dealing with the effect of PBTE training on the types of objectives teachers set for their classes, the amount of progress

their students saw themselves as having made, and the perceptions of students concerning five different aspects of the classroom environment were evaluated.

It was found that no significant differences occurred between science teachers having different amounts of PBTE training in the importance they lent to humanistic and nonhumanistic objectives, or in their students' perceptions of the progress they made toward those objectives when they were considered essential or important by the teacher. No significant differences between groups were found for any aspect of classroom environment except for the use of texts and resources. In that area, increasing amounts of PBTE training resulted in teachers being viewed as less humanistic.

It was also found that no significant differences occurred among groups for the effects of the eleven other factors on the type of objectives teachers stressed. Significant differences did occur for some factors, however, in student perception of progress made toward objectives considered to be essential or important by the teachers. Student view of the progress they had made increased as the size of the certifying group increased, in the teacher's recollection, until a peak was reached at the "50-100 science teachers" category, then decreased in the "over 100 science teachers" category. In addition, Physical Science students were found to perceive themselves as having made significantly less progress toward nonhumanistic objectives than other students, while Biology students believed they had made significantly more progress toward these same objectives.

Earth Science students were found to view their teachers as less humanistic than other teachers in the area of teacher role in the classroom. Regarding teacher behaviors in evaluation and testing, Physical Science and Chemistry teachers were deemed more humanistic than other teachers, while Earth Science and Biology teachers were deemed less humanistic. Life Science stu-

dents viewed their teachers as being less humanistic than other teachers in their laboratory and classroom management behaviors. Teachers trained in completely modularized programs were viewed by their students as being less humanistic than either course-trained teachers, or those trained in a course-module combination, in the area of teacher role, evaluation and testing behaviors, and laboratory and classroom management behaviors.

Within the limitations of this study, the results seem to indicate that the humanistic behaviors of science teachers are little influenced by their training program. Teachers trained in PBTE programs are no more or no less humanistic than teachers lacking PBTE training.

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CHAPTER I

INTRODUCTION

The performance of teachers in the classroom has, in recent years, come under increasing criticism by writers within and without the professional ranks of education. In part, this criticism has been leveled at teacher training programs. It is reasoned by the critics that if the training programs were indeed thorough and adequate, incompetents would be weeded out, and program graduates would be performing properly in the various roles assigned them in the classroom. Charles E. Silberman (48) typifies the critics when he states:

> The question, then is . . . what kind of preparation they /the prospective teachers/ should receive. That the preparation should be substantially different from what they now receive seems hardly open to debate; there is probably no aspect of contemporary education on which there is greater unanimity of opinion than that teacher education needs a vast overhaul. Virtually everyone is dissatisfied with the current state of teacher education: the students being educated, the teachers in the field, the principals, superintendents, and school board members who hire them, the liberal arts faculties, and the lay critics of education.
>
> Dissatisfaction is even beginning to penetrate the inner sanctum of the educationist "establishment" itself.

In partial reaction to these criticisms, new approaches in teacher training have been proposed and implemented. One of these new approaches has been termed Performance or Competency Based Teacher Education (PBTE or CBTE). PBTE has been defined by Karl Massanari (1) as,

> A program designed specifically to provide the prospective teacher with learning experiences that will prepare him to assume a specified teaching role. Successful completion of the program is accomplished only when the teacher candidate provides evidence that he possesses specified requisite knowledge and can carry out in practice specified teaching functions.

A further definition imposed by Elam (19) is that ". . . performance

goals are specified, and agreed to, in rigorous detail in advance of instruction."

Such a program of teacher education could be expected to differ in design from traditional training programs in several respects. Traditional programs have been termed experience based (19). The teacher is considered trained when he or she has successfully participated (as indicated by appropriate grades) in a series of classes designated as essential. Performance based programs, however, would require proven ability to use the knowledge gained from training. In addition, performance based programs would require more systematic specification of that which is to be known by the trainee and stringent, systematically derived and applied assessment criteria (46). Such specifications and assessment would be made through the use of behaviorally stated objectives.

NEED FOR THE STUDY

PBTE

During the last decade, interest in, and development of, performance based programs has grown substantially. Over 30 states are involved in consideration of PBTE as the means of certification of teachers (45). Many universities have already implemented PBTE programs for the full range of professional education classes (12, 20). Other universities have incorporated the PBTE concept in one or more courses of this professional sequence.

Two major arguments, however, remain unresolved concerning PBTE, despite this growing popularity. First, the basic assumptions underlying PBTE have not been substantiated. One such assumption is that "good" teachers have at least some characterisitics which can be stated behaviorally and taught. Broudy (8) believes that the search for a set of behavioral traits that will

uniquely determine a good teacher is a blind alley because the number of variables is indefinitely large, their effects are impossible to isolate, variable relevancy is unknown and cannot be determined by statistical analysis of neatral data.

A second assumption, shown by the emphasis given in PBTE programs, is that field practice is at least as important as discussion of theoretical foundations. Broudy believes that performance trained teachers will be weak in theory, and theoretical training separates the professional from the craftsman (10).

Finally, an implied assumption in implementing PBTE programs is that the consistent use of, and emphasis on, observable behavior will have no detrimental effects on the interpersonal activities engaged in by prospective teachers. Little evidence, however, has been gathered to justify or deny statements about the effect of a behavioral approach on those so trained.

The second argument revolves around the humane behaviors of teachers. Humaneness is defined in Webster's Third New International Dictionary as the quality of being marked by compassion, sympathy or consideration for other human beings. A humane or humanistic teacher, then, would be one whose behavior would include displaying these qualities toward his students. It would be expected as well in the author's view, that students would be able to observe these qualities in their teachers.

Humanists argue that the Behaviorists tend to trivialize education and ignore the affective development of the prospective teachers (14). Humanistic goals cannot be behaviorally stated (47), they say. Thus, by instituting performance based programs, compassion, sympathy and consideration of others, the humane teaching behaviors, will be neglected more than they are already, and production of non-humane, trivia-oriented craftsmen will result.

Training Programs and Humanistic Behavior

Correlation has been found between student attitudes and achievement and the directness or indirectness of teacher behavior (2, 24, 25, 27, 28). The more indirect behavior displayed by the teacher, the more positive are student attitudes toward the class, teacher and subject, and the greater are their achievements in the class. Direct behavior, on the other hand, has generally resulted in a decrease in the positiveness of student attitudes and lower achievement levels. These positive attitudes could be considered as a measure of the acceptance students feel in the class, and hence, as a measure of the humaneness of the teacher as viewed by the students. Thus, it could be considered that the more indirect the methods used by the teacher, the more humane are that teacher's behaviors.

Flanders and Simon (25) report that training in interaction analysis and feedback on classroom behavior increased the amount of indirect behavior exhibited by teachers in several studies they reviewed. Training, then, can be used to influence teacher behavior, which in turn can influence students' attitudes about the classroom environment.

New Science Curricula

Emphasis in many of the new secondary school science curricula has been on increased used of the inquiry technique, including more classroom discussion and laboratory work and less lecture. Teachers utilizing these curricula should, then, be more indirect in their approach to encourage student interaction. Lack of such indirectness could result in defeat of the purposes of the new curricula before starting.

PURPOSE OF THE STUDY

What, then, is the effect of PBTE training on teacher behaviors and

on student reaction to those behaviors? Do students of science teachers trained in PBTE and non-PBTE programs differ in (1) their perceptions of the classroom environment and (2) their perception of their progress toward classroom goals of science? Do PBTE and non-PBTE trained teachers differ in the types of goals they select and implement?

The purpose of this study is to provide evidence concerning the effect of a behavioral training program on selected humane behaviors of science teachers. The types of objectives chosen and implemented, the progress of students toward these goals, and the types of teaching behaviors exhibited by teachers trained in PBTE and non-PBTE programs have been analyzed. Thus, evidence is provided for training institutions to examine the effects of training in whatever competencies they stress, and for modification of instructional programs used to train prospective teachers.

Data concerning the effect of a behavioral training program on teacher behavior was gathered utilizing selected science teachers who had been certified by one of six colleges which cooperated in this study. Two evaluative instruments were completed by the teachers, one dealing with their training programs and a second dealing with the type of goals they would select for their classes. Two evaluative instruments were completed by one class of science students of each teacher. These instruments concerned the progress the students felt they had made toward the goals selected by the teacher and student perception of several aspects of the classroom environment.

DEFINITIONS

The following definitions are given here for clarification in reporting this study:

1. Performance Based Teacher Education--A method of teacher training where the objectives of instruction are outlined in advance, and successful

completion of a topic requires some observable method of displaying that the competencies described in the objectives have been developed. Such displaying will usually incorporate examination methods in addition to, or in place of, tests of content recall.

2. Module--A complete, self-contained set of learning and evaluation experiences intended to facilitate the student's attainment of a stated set of objectives.

3. Humanistic Behavior--Those teacher behaviors which are indirect and result in a student-student or student-teacher interaction.

4. Indirect Behavior--Those behaviors which extend student freedom to interact with other students and the teacher; used in the sense of the four indirect categories developed and utilized in the Interaction Analysis system of Flanders.

5. Human Relations Training--An organized program of training in the theories of human psychology, experience in the recognition of these theoretical activities in humans, and practice applying these theories to classroom situations.

SUMMARY

Increasing criticism in recent years of classroom teacher performance has led to the development of new approaches to teacher training, one of which has been termed Competency or Performance Based Teacher Education (PBTE). The chief characteristics of PBTE programs are the use of behavioral objectives to specify required competencies in advance of training, and evaluative means that require exhibition by the prospective teacher of the required competency.

PBTE opponents argue that (1) such programs are built on unsubstantiated assumptions and that (2) teachers trained in a PBTE program will be trivialized and inhumane. This coupled with evidence that indirect, inter-

active teacher behavior results in positive student attitudes toward classroom environment, and that training can increase the amount of indirect behavior exhibited by teachers, lead to the need to study the humanistic, interactive behaviors of PBTE-trained teachers. The emphasis in the new science curricula on inquiry requires teachers to increase the freedom of students to express themselves and interact with others. Thus, the need exists to study the humanistic behaviors of PBTE and non-PBTE trained science teachers.

The purpose of this study is to provide evidence concerning the effect of PBTE training on selected humanistic behaviors, using data provided by science teachers and their students, on goal selection and implementation and teacher behavior.

CHAPTER II

REVIEW OF RELATED LITERATURE

FACTORS CAUSING THE RISE OF INTEREST IN PBTE

The rise of PBTE programs has been the result of several factors in combination. One factor concerns the effects resulting from an increased interest in educational accountability (46). Increasing criticism of education, including teacher education, has been the trend for the past several years. The cost of classroom activities in terms of taxpayers' dollars, a decrease in support for the belief that unmet educational needs needed to be met, and concern over the inability or failure of public schools to teach basic skills have led to an increasingly vocal outcry for education to be accountable for its product, the student (6).

Doubts have been raised as to the ability of current teacher education programs to properly train teachers for current roles. Broudy (8) indicates, "The gap between what we expect from the classroom teacher and the preservice training we provide to meet these expectations is broadening, not diminishing." Haynes and Coyne (30) question the whole theoretical structure of traditional programs.

> . . . a teacher education program which depends upon a sequence leading from an abstract, theoretical, academic study of education to a final massive dose of experience is unsound; likewise, any professional program which finally delivers the student into the hands of one or two "master teachers" who are to show him how to teach is ineffective.

The question is then raised, should not teacher education programs be accountable to the public and show some evidence prior to hiring that a teacher-candidate is capable of doing the teaching job he is being hired to perform?

> If a teacher is to be accountable for bringing about specified classes of learner outcomes or non-instructional outcomes subsequent to certification, it would seem reasonable to require that prospective teachers demonstrate that they can bring about such outcomes prior to certification (46).

A second source of impetus to the growth of PBTE lies in a direction somewhat opposed to the factors cited above. Increasing awareness of individual differences and of the failure of education to take these differences into account has led to societal demands that more progress be made in narrowing inequalities between different aspects of our society (19).

A third factor has been the increased interest of state and federal agencies and professional organizations in PBTE programs. At least thirty states are considering or developing programs of certification based on performance (45). The state of Washington has incorporated a certification system with performance criteria based on behavioral objectives, and employing four levels of certification (4). New York has developed a list of proposed standards for certification using performance objectives and competencies (5).

The Texas Education Agency mandated a state-wide program of PBTE, which was to include all course work, not just the professional education sequence. A recent State Attorney General's opinion, however, has denied the Agency the right to issue such a mandate.

The United States Office of Education has provided funding for the development of ten model elementary teacher education programs, all of which use some form of performance based instruction; and for a number of Teacher Corps programs using performance based designs (20).

The American Association for Colleges of Teacher Education (AACTE) has been very active in surveying the programs, researching opinions and attitudes involved in performance based programs, and has developed standards requiring faculties to define the professional role of teachers and design

preparatory programs based on these definitions (20).

A fourth factor giving rise to the performance based concept is the interest and change in education as a profession. Included as part of this factor is the rise in use of behavioral objectives, and popularization of research on teacher behavior. Investigators have also recognized the futility of searching for teacher characteristics or background which will serve as predictors of teacher success (46).

The final factor concerns the need for and kind of educational decisions made in classrooms. As Cohen and Hersh (14) indicate, "But one fact--that educators do make decisions about goals--indicates that somewhere, somehow, some criteria for judgments do exist. These have all too infrequently been searched out and examined." They then go on to list four questions which they feel are applicable to all educators, regardless of philosophy or ideology.

1. What would I like my students to be able to do, know, and/or feel as a result of their experiences in this course? (Goals)

2. What evidence do I have that any or all of these goals have merit for any student? (Rationale)

3. What instructional procedures can I employ to help each student to attain his goals? (Instruction)

4. What evidence do I use to decide if goals are being attained? (Assessment)

PBTE arose out of a desire to find the judgmental criteria that would produce the most beneficial results. As Morris (41) states, ". . . while it is probably impossible to identify all the competencies a teacher should possess, those competencies which <u>can be</u> identified <u>should be</u> identified."

STRENGTHS OF PBTE

The newness of the PBTE movement has produced a situation where more has been written about what PBTE should or should not do, than what it in fact does or does not do. Hence, the literature can be grouped into two general categories: Arguments and Results of research.

Educators involved in developing PBTE programs and investigating their worth have been disenchanted with traditional teacher education programs because of certain lacks which they see in these programs. Cohen and Hersh (14), in summarizing arguments between behaviorists and humanists, have compiled the following series of arguments which can, in the view of the author of this study, be used to represent the drawbacks of traditional teacher education programs.

A. Humanists refuse to admit goals, or state them so globally that they become mere platitudes.

B. Values, attitudes and feelings (affective characteristics) are inferences made about a person based on samples of his observed behavior.

C. Humanists are rhetoricians, not educators; their goals sound nice, but little or no evidence is presented to indicate they are capable of attainment.

D. Humanists are not concerned with questioning their instructional procedures or capable of doing so systematically.

E. Humanists evaluate their instructional effectiveness according to whether they feel good about it, or do not evaluate it at all because they feel that the evaluation process is dehumanizing.

Summarized, these arguments appear to say that the current goal setting and instructional practices do not allow or even make available a systematic approach to improvement.

Elam (19) sees the following beneficial promises offered by performance based programs:

1. There is a focus on objectives, and an emphasis on students and teachers sharing ideas in advance to form objectives.

2. Responsibility for learning is shifted from the teacher to the student.

3. There is increased efficiency in teacher training through systematic use of feedback.

4. Greater attention is paid to individual variation among students.

5. Learning is tied directly to objectives rather than to resources.

6. Teachers are taught in the way they are expected to teach.

7. PBTE is consistent with democratic principles.

8. It is consistent with current psychological knowledge.

9. It integrates theory and practice.

10. PBTE provides a better basis for designing research about teacher performance.

He further sees some definite implications resulting from these strong points of PBTE. First, there will be increased interaction in decision making by institutions, professional associations, state departments and public schools. Second, certification will no longer be automatic. Third, performance analysis of teacher training institutions can be made. Finally, the role of the inservice teacher can be better described and studied, and systematically improved.

Shepardson (47) cites other potential strengths of the PBTE programs.

A. A behavioral statement of course and program objectives will provide students with a better understanding of the program as a whole and the specific expectations held for them.

B. Minimum criteria for students could be defined.

C. Analysis of task and defining destination make the job of selecting the appropriate vehicle more accessible.

D. With an entire department focusing on certain desired skills, teachers are more likely to enter teaching possessing these skills.

E. If minimum performances are specified, remedial measures can be more easily prescribed and diagnosed.

In 1969, Blosser and Howe (7), in analyzing research concerning the education of science teachers, reported:

> Few articles could be found that indicated the kind of teacher produced by a program, or the kinds of competencies, skills, or characteristics developed through planned experiences. It would appear that little is known concerning the specific effects of teacher education on science teachers.

Research since then, however, has provided some evidence to support the arguments for PBTE.

Specific programs of PBTE teacher training have been established at many universities. In addition, individual classes, which are part of the professional education sequence, and which are all or part performance based, are common. Szabo and Bell (51) have developed a performance based program in science at Pennsylvania State University. Competencies and evaluation methods are established by the instructors, and students select the path of instruction and schedule themselves according to a contract. It was found that typical measures of achievement could not discriminate between the PBTE trained students and traditionally trained ones. Further, the PBTE trained students spent less time on the course, but more time in conference with the instructor.

In the Nebraska Secondary Teacher Education Program (NUSTEP) at the University of Nebraska, it was found that teacher education students liked PBTE

better than traditional instruction, and that students taught by NUSTEP trained teachers had greater achievement. The NUSTEP teachers conformed to an innovative model better, displayed greater ability to select and use a variety of teaching skills and strategies, had more positive attitudes toward innovation, made better student teachers, ranked NUSTEP better than student teaching, were more confident, and were more effective with students (50).

Teacher Corps PBTE programs have been implemented at San Francisco State College and Western Kentucky University. Students at San Francisco thought the theory behind the program was good, but the program was disorganized (26). Estes (21) felt that the Western Kentucky program was effective and that the students felt the same.

Ricker and Hawkins (44) found that significant learning occurred from use of a performance based module in science at Georgia University. Several different avenues were open to the students to achieve the competencies, but most students chose a combination of laboratory experiences.

Using the performance based format in supervision of beginning teachers, McNeil (39) found that use of behavioral objectives resulted in greater gains in the desired direction, no undue pressures, no restriction of pupil advancement, and increased achievement in a variety of areas. A pattern found in other studies (18, 22, 25, 43) shows the use of behavioral objectives to result in neutral or positive attitudes in students.

Elfenbein (20) surveyed thirteen performance based programs in Alabama, Florida, Georgia, Minnesota, New York, Texas, Utah and Washington and analyzed them for common structure and accomplishment. The following are some of her observations about the strengths of performance based programs in general:

1. PBTE programs assumed greater responsibility for their product.

2. Systems theory was utilized in all programs.

3. New perceptions regarding roles and responsibilities of teachers were gained.

4. The rationales of the programs indicated a desire to train teachers competent to work with minority groups.

5. The programs have a purpose which is identified and public, providing unity and cohesion to professional training.

6. Organization of PBTE programs takes into account time, program and staff.

7. PBTE programs have different contexts in mind for their students--differentiated staffing, continuous progress education, meeting unmet needs of the students, and teaching the underprivileged.

8. Human relations, the linkage between people and organization, is an important phase of most PBTE programs.

WEAKNESSES OF PBTE

As previously stated, criticism of PBTE on a theoretical level rests in two general areas of perceived weaknesses. First, opponents of performance based programs argue that the basic assumptions underlying the performance concept are wrong. Cooper (16) states,

> Before one can specify teacher competencies he should first specify what effect he wishes the teacher to have on pupils. . . .While this appears to be a simple statement of the obvious, its implications are anything but simple. When desired pupil outcomes are specified, how confident can one be of his ability to define teacher competencies which will in fact facilitate those outcomes?

Broudy (9) argues that the search for a process or strategy common to all good teaching is a blind alley because the process picked depends on the outcomes desired.

Howell (32) believes that "any particular teaching performance is

limited by time and place and other aspects of the immediate situation and must be regarded as only a small sample of the large collection of activities called teaching, which have direct or indirect effects on learning."

A second argument advanced against the assumptions underlying PBTE concerns the need for evaluation to be public or commonly understood. Broudy (8) is the chief proponent of this point of view. He states that the idea that a teacher training program ought to be judged by the quality of the teachers it sends out is a waste of time because the criterion of judgment cannot be defined. Further he says,

> Criteria need only meet the criterion of being usable by experts, i.e. those men and women who carry in their heads models by which they scale what they observe.
>
> Much of our difficulties with evaluation, I believe, lie in our inveterate faith that observational schedules can take the place of expertise. It is as if vintage wines were to be judged by a jury of citizens armed with a handbook on viticulture.

A second major weakness of PBTE cited by its opponents lies in the type of product--teachers--that will be turned out. It is felt that the current system of training is not producing the kind of teacher needed for modern education, and that PBTE will simply turn the same type of teacher out, only more efficiently. Dickson (17) states that "most teachers appear to be basically conservative by nature and the general evidence from their efforts and the product of their programs indicates substantial satisfaction with the status quo." Broudy (10) arguing against the strengths previously cited by Elam, indicates that present teachers are not professionals--skilled in theory--but technicians. He sees PBTE as a high-ranked apprenticeship emphasizing task accomplishment, nottheory, thus preserving the status quo. He further indicates that PBTE will produce teachers capable only of didactic teaching, emphasizing facts and details, not generalizations and aesthetics (1).

Combs (15) sees the behavioral approach to accountability as having

several drawbacks.

1. It is a symptomatic approach, and is not concerned with causes.

> The behavioral objectives approach is not wrong. It would be easier to deal with if it were. The danger lies in that it is partly right, for in the realms of human affairs, nothing is more dangerous than a partly right idea.
>
> . . . it is apparent that the behavioral objectives approaches to accountability are applicable only to the simplest and most primitive aspects of what is expected of modern education.
>
> Failure to understand this symptomatic character of behavior has for generations frustrated the efforts of educators to deal with many problems. It makes a great deal of difference what a teacher believes is the most important thing to look for in working with children. If his attention is riveted on the child's behavior and the necessity to change it, the techniques he will almost certainly employ will be managerial attempts to control and direct behavior.

2. It is a closed system, searching only for right answers.

3. It distorts the thrust of education because it presents a very narrow view of the teacher's role.

4. It demoralizes teachers.

In addition to maintaining teacher education as it is, some authors feel that the organization and operation of a PBTE program will trivialize and dehumanize prospective teachers. Cohen and Hersh (14) summarize these feelings with the following arguments against the behavioral approach. First, behaviorists trivialize education by relying on the most easily observable and specifiable objectives. Second, the affective domain is ignored. Third, behaviorists ignore the rationale for goals and serve the status quo. Finally, behaviorists promote programmed instructions as a panacea and advocate a lock-step conditioning that smothers individual differences. Behavioral technology will produce people incapable of making independent decisions or going beyond the information given.

Shepardson (47) summarizes some of the arguments against PBTE into the following points:

A. Specification of goals and performance objectives for a teacher

education program does not of itself make a program. Many aspects of a humanistic teacher go beyond objective specifications. There is need to work together for a common goal.

B. Some goals cannot be behaviorally stated, particularly relevant and humane factors.

C. Commitment to PBTE should not be made before concensus is reached on the behaviors to be stressed.

With the recognition that not all aspects of a teacher's role can be behaviorally stated, because of their aesthetic nature, Howsam (33) makes the following observation: "Evaluating teachers on their competencies in some aspects of their work and not in others tends to cause undesirable shifts in emphasis in teaching to those areas where results can and must be shown."

Research has not generally supported the arguments that these theoretical weaknesses do exist in PBTE. Problems encountered in the programs have been in administration or development of the programs, or in student operation in the program. In reporting on the program at Illinois State University, Getz (28) indicates that scheduling, printing, supervision, and maintenance work occupied a great deal of their time. Students were chiefly concerned about unavailability of materials, adjustment to the constant pressure, the amount of work in the program, and the cumbersome nature of feedback. Some indication of the theoretical weaknesses was noted also. Difficulties such as the following were observed:

1. Behaviors such as flexibility could not be measured.
2. High level competencies were lacking.
3. There was a lack of appropriate measurement tools.
4. Connecting the discrete modules into a unified whole was a problem.
5. Restriction of innovativeness of staff because of required modules

was apparent.

In the previously discussed study by Elfenbein (20), the following weaknesses common to PBTE programs were found:

A. The programs require a clearer conception of the program and its product--the teacher. Although all programs have rationales explaining why they are engaged in PBTE, terminal objectives for the program are not always clearly stated.

B. The management (tracking) of student and personnel was not always efficient.

C. The synchronization of college activities and field experiences was sometimes dysfunctional.

D. None of the programs had available reliable and effective assessment tools which could report comprehensive hard data about multiple aspects of performance.

E. Most PBTE programs are designed to train teachers for the near future.

In summarizing the arguments and evidence for and against PBTE, it could be stated that proponents of PBTE feel that change is needed in a manner open to empirical study, and that some evidence indicates that PBTE can provide that change and that manner of study. Opponents argue that the assumptions of PBTE are unsound, and that the end product of a PBTE program will not be the kind of complete, unfragmented, holistic teacher desired. Research evidence generally does not support the arguments of PBTE opponents. Many administrative and procedural problems, however, do exist as PBTE programs are developed and implemented.

HUMANISTIC EDUCATION

Paralleling the development of PBTE has been the rise of interest in

humane or humanistic education. Humaneness has been defined by Herbert A. Thelen (52) as caring, and ". . . the quality of experiencing or interacting. You cannot," he says, "be humane all by yourself. . . ."

The reason for interaction being at the heart of humanistic behavior is the incompleteness of a child's development and the continuing progression of the child toward completeness. "The child is to be conceived as having the whole range of human attributes developed to an extent characteristic of his age and social and cultural belonging. He . . . is in a state of becoming (52)." And as Torrance (53) states:

> A child cannot become human by learning only from the experiences of others. To become human, one must establish his own anchors, his own contact with reality.
>
> Teachers tend to overrate the finished product or the masterpiece--the finished poem, the masterpiece of music or art, the balanced interpersonal relationship, the smooth functioning of the championship team. This tendency makes it difficult for them to appreciate the value of imperfect, yet original and promising ideas.
>
> Schools can contribute to the child's struggle to become human by helping him to acquire the motivations and skills for finding out throughout his life.

A humane teacher, then, can be conceptualized as one who allows student interaction in the classroom, that the potential inherent in the student may be allowed to be expressed and developed.

The impetus to the development of interest in education toward humaneness has been in the increased recognition of variation among individuals, and in the growth of holistic or gestalt psychology. The rationale behind its inclusion in education is the desire to deal with these differences between people and to train each individual as a whole person, and not simply as a sum of separate parts. Combs (15) states, "Humanistic approaches to psychological thought provide us with theoretical guidelines to effective practice consistent with . . . broader goals. It is high time that these new conceptions be made an integral part of the training of educators and given wide

dissemination throughout the profession."

Patterson (42) comments on the inclusion of humanistic patterns in teacher training programs:

> It is the person of the teacher which is the most important factor in teaching and learning. It is therefore apparent that teacher education should focus upon the development of the person of the teacher.
>
> Teacher education is more than teaching of subject matter. . . . It must be concerned with the development of persons with humanistic beliefs about people and attitudes toward them.

It is recognized by the author that models of humane behavior, good or bad, are presented to prospective science teachers by every teacher by whom they have ever been taught. Such models undoubtedly have their effect on the classroom behaviors of prospective teachers. Little has been done until recent years, however, in traditional programs to attempt to develop humanistic behaviors in new teachers.

The majority of literature concerning humanistic education has concerned itself with theoretical rationales for inclusion of humanistic programs in teacher education, or with proposals for models of such programs. Monez and Bussiere (40), in discussing the qualities to be examined in young people to determine their humaneness, list the following:

1. Autonomy and sensitivity to experience.
2. Open-endedness and responsibility.
3. Objectivity and involvement.
4. Complexity and perfection.
5. Spontaneity and creativeness.
6. Integrity and humaneness.

Such qualities would also be worth examining in prospective teachers.

In outlining some general characteristics of a humane teacher education program, Patterson (42) indicates that essential to such a program would

be model teachers to display humanistic teaching, previously determined criteria of humanistic behavior, and an emphasis on holistic, applied psychology.

A model for incorporation of humane teaching into a high school science course has been proposed by Bybee and Welch (11), and could easily be applied to methods courses in science teacher preparation. It includes the following steps:

A. Cause the teacher to examine his own beliefs, attitudes and values toward science and education.

B. Create conditions that emphasize maximum development of student potential.

C. Deal openly with values and attitudes as well as conducting laboratory activities and promoting cognition.

D. Require the teacher to understand that concepts of self are as important as the concepts of science.

E. Give emphasis to personal meaning as well as to knowledge.

F. Give emphasis to the ends of science as well as to the means.

They indicate further that humanistic psychology must be incorporated into science teaching to focus science education on the uniqueness of man.

Patterson (42) indicates that humanizing the course work of teacher training and ignoring the student teaching aspect could produce disasterous results.

> Practice teaching, which is one of the most important experiences in teacher education, is one of its major problems. . . . In fact, if the rest of teacher education becomes humanistic in its orientation and practice teaching continues as it is now, it can be a traumatic and damaging experience for the student.

A program of humanized teacher training has been proposed by Iannone and Carline (35) consisting of three blocks of experiences: (1) Human Encounter with Self, Community and Youngsters, (2) Human Encounter with Basic

Teaching Skills, and (3) Human Encounter with Real Teaching.

Much experimentation in humanizing individual courses, or in adding human relations training to the programs of selected students has been done.

Two programs which have actually implemented some form of humanizing training have been reported. Weber State College has developed a modularized program in humane skills for use in its PBTE program. The module utilizes readings, activities, and some modified sensitivity training, and has met with some success (3). Ivey and Rollins (36) report development of a human relations program using performance criteria based upon a heirarchy of increasing difficulty which has also met with some success.

CLASSROOM INTERACTION

Research in classroom interaction has great bearing on developments in both PBTE and humanistic education. There is evidence that the more indirect, interactive behavior exhibited by the teacher, the more positive will be student attitudes toward the teacher, class and subject and the greater will be their achievement. "The preponderance of evidence gathered so far would indicate that most currently practicing teachers could adopt patterns which are more responsive to the ideas and opinions expressed by pupils and realize a gain in both positive pupil attitudes and pupil achievement (25)."

Cogan (13) and Flanders and Simon (25) indicate a significant correlation between positive attitudes, independence and high achievement, and indirect teacher behavior. LaShier (38), Amidon and Hunter (2), Furst (27), and Flanders (24) report supporting evidence.

As previously indicated in Chapter I, training in the techniques of Interaction Analysis result in more indirect behaviors being displayed by teachers (25).

CHAPTER III

THE STUDY

THE SAMPLES

Selection of Universities and Colleges

Six colleges in three states were selected to cooperate in the study. These were:

1. Weber State College, Ogden, Utah
2. Brigham Young University, Provo, Utah
3. Indiana University, Bloomington, Indiana
4. Ball State University, Muncie, Indiana
5. The University of Houston, Houston, Texas
6. The University of Texas at Austin, Austin, Texas

Colleges 1 and 3 were over 75% performance based in their science education curriculum, while colleges 2, 4, 5 and 6 were less than 25% performance based. The states represent different geographic regions of the United States--Midwest, West and South. Colleges 2, 4, 5 and 6 are over 20,000 in student population; college 3 is over 10,000; and college 1 is less than 10,000. Colleges 1, 2 and 5 train less than twenty-five science teachers per year; college 6 trains less than fifty science teachers per year; and colleges 3 and 4 train over one hundred teachers per year.

Selection of Teachers

Teachers were selected in two ways for use in the study. The first way involved selection by mail, and the second, selection by personal contact.

(1) During the fall months of 1973, contact was made with each of the colleges and a list of students who had graduated in science education since

the 1970 fall semester was requested. Letters were written to each of the people whose names were so obtained, explaining the nature of the research project, and requesting them to participate. This method proved less than satisfactory for several reasons. First, the colleges found it difficult to supply current addresses for their graduates, and old addresses, particularly those over one year old, were generally inaccurate. Second, approximately 30-40% of the teachers never responded. Third, of those that did respond, from 40-70%, depending on the university, indicated that they were not currently teaching. Despite these drawbacks, 14% of the participating teachers --three from Brigham Young University and five from Ball State University-- were identified and agreed to participate as a result of the mail contact.

(2) During the latter part of January and the first two weeks of February, the author traveled to Utah, Indiana and within Texas and contacted school districts in the vicinity of each of the colleges. Through administrators in each of the districts visited, names of graduates from the selected colleges during the appropriate years who were currently teaching science in the district were secured. Contact was then made with each of those teachers. The research project was explained to the teacher and a request issued to participate in the study. Forty-eight teachers were contacted personally and agreed to participate.

Fifty-six teachers completed instruments used to gather data concerning the type of teacher training programs they underwent and the types of goals they would choose for their classes. Of this number, fifty had their students complete instruments dealing with student perceptions of their progress in the class and of the classroom environment.

Selection of Students

Each of the participating teachers was asked to select one class of

their science students to participate. No attempt was made to influence the teacher's choice as to which class would be utilized.

INSTRUMENTATION

Development of the Instruments

Four instruments were developed for use in the study:

The General Information Questionnaire (GIQ) (see Appendix A). Three aspects of each teacher's background were selected as influences which could affect teacher behavior. First, age, sex, and the subjects and level at which they were currently teaching were determined. Second, data about teacher perception of the size of the university population and student teaching groups were collected. It was felt by the author, based upon conversations with students concerning their attitudes toward life on a large campus, that the size of the university population and student teaching groups might influence the humanistic behaviors of students. Third, information was sought concerning the training program, including amount of PBTE training, amount of time spent in conference with instructors, mode of program organization, inclusion or exclusion of standard professional courses or topics, and the types of human relations training experiences, if any.

The purpose of the study is to determine the effects of PBTE training upon selected humanistic teacher behaviors. The other items were included as being representative of other factors which might influence these aspects of teacher behavior, and thus dilute the effect of the training program. It was to see whether this possibility of dilution did in fact materialize that these other items were included.

The Science Objectives Inventory (SOI) (see Appendix B) and the Student Progress Inventory (SPI) (see Appendix C). These two instruments were

derived from a study by Hoyt (34) performed at Kansas State University. In the study, Hoyt developed eight objectives that could be applied to any undergraduate course at the university. The eight objectives were:

a. Gaining factual knowledge (terminology, classification, methods, trends).

b. Learning fundamental principles, generalizations or theories.

c. Learning to apply principles to solve practical problems.

d. Understanding myself--my interest, talents, values, etc.

e. Learning attitudes and behavior characteristics of professionals in the field most closely related to this course.

f. Developing skill in effective communication.

g. Discovering the implications of this course material for my personal and professional conduct.

h. Gaining a broader understanding and appreciation of intellectual-cultural matters (music, science, literature, etc.).

In Hoyt's study, the instructors of 708 undergraduate classes were asked to rank each of the objectives as being essential, important or insignificant for their class. The students in each of these classes were then asked to indicate the amount of progress they felt they had made toward each of the goals. Analysis of the correlation between student progress, teacher selection of goals and teacher characteristics was then made by determining the average student progress for each of the goals that instructors had ranked as important or essential.

The SOI and SPI were developed by taking the eight objectives of Hoyt and using them as categories. Twenty objectives were then written in the eight categories. The objectives were written so as to emphasize either a student working alone, or involved in working with other students or the

teacher of the class.

This writing thus developed objectives that were humanistic (causing interaction on the part of the students) or nonhumanistic (not developing interaction).

The SOI and SPI differ in that the objectives on the SPI are worded as questions. The use of the two instruments was similar to that used in the Kansas State study. Science teachers were asked to rank each of the objectives on the SOI as being essential, important or insignificant for their science classes. Students were asked to indicate on the SPI the amount of progress they felt they had made toward each goal.

The Science Classroom Activities Inventory (SCAI) (see Appendix D). This instrument was based on the Biology Classroom Activities Checklist of Kochendorfer (37). The purpose of the instrument is to determine student perception of the behavioral patterns of the teacher in the classroom environment. These statements listed by Kochendorfer were examined with the purpose of determining whether the statements reflected an interactive behavior on the part of the teachers and students. Most of the statements did fit the criteria and were used; those not fitting the criteria were discarded. Several other statements were added to emphasize areas not included in the Kochendorfer instrument, particularly in the section on tests and grading.

Five areas of classroom environment were included in the instrument:

a. Teacher Role--Section A

b. Student Participation--Section B

c. Use of Texts and Resources--Section C

d. Tests and Grades--Section D

e. Laboratories and Classroom Management--Section E

The instrument was comprised of forty-three statements: nine in

section A, eight in section B, six each in sections C and D, and fourteen in section E.

Students were asked to answer each statement with a T (true) if the statement accurately described the classroom environment in their class, and an N (not true) if the statement was not accurate of the environment.

Reliability and Validity Determination

Validity of the SOI and SPI was determined by submitting the SOI to a panel of five judges. Each judge was asked to indicate which of the objectives would, if implemented, result in more student-student, student-teacher interaction in the classroom. The judges all held the Ph.D. in science education, or were candidates for that degree, and all had extensive experience in teaching science in both public schools and colleges. The reliability of these judgmental ratings was determined using the intraclass correlation method of Guilford (29) as follows:

$$r_{cc} = \frac{V_r - V_e}{V_r + (k-1) V_e}$$

where

V_r = The variance between items

V_e = The variance for error

k = The number of judges

The judgmental reliability coefficient thus determined was .42. At least four of the five judges agreed that the following statements on the SOI were humanistic objectives: 2, 5, 8, 15, 16, 17, 18, 19. In like manner, the following statements were judged to be nonhumanistic: 1, 4, 6, 7, 9, 10, 11, 12, 13. These judgments correlated exactly with the author's determination of humanistic and nonhumanistic objectives. The judges were divided two to three

on statement 3, which had been written as a nonhumanistic goal by the author; and on statements 14 and 20, which had been written as humanistic goals.

Validity of the SCAI was also determined using the same panel of judges and the intraclass correlation method of Guilford. The judges were asked to put a T (true) next to those statements which would accurately describe a classroom where a great deal of student-student, student-teacher interaction was occurring, and an N (not true) next to those statements which would not accurately describe such a classroom.

The judgmental reliability coefficient thus determined was .68. Table 1 shows the choices made on the SCAI statements by at least four of the five judges. These choices correlate exactly with the author's judgment of the same statements, except for statement E13. The judges disagreed on the correct answer for the statements left blank. The author's choice for these statements is indicated in parentheses.

The heterogenous nature of the instruments used, and the lack of a retest in the study, pose difficulties in determination of reliability. As Guilford (29) points out, the retest method is the only meaningful estimate of reliability of a heterogenous instrument. Lacking the ability in the study design to conduct such a retest, a determination of the internal consistency of the instruments was conducted to determine to what extent significant differences on individual objectives or statements listed on the instruments should be discussed.

The reliability measure of Horst (31) was used to determine internal consistency for all three instruments. This method assumes that all variance in intraclass scores represents error variance, and the interclass variance expresses true variance. If the SPI and SCAI are reliable measures of classroom activity, we would expect greater intraclass than interclass variance.

T A B L E 1.--Judges' choices on Science Classroom Activities Inventory statements

Section A	Section B	Section C	Section D	Section E
1. T	1. N	1. N	1. N	1. - (N)
2. N	2. T	2. - (T)	2. - (T)	2. T
3. T	3. N	3. N	3. N	3. T
4. N	4. T	4. T	4. T	4. N
5. - (T)	5. N	5. N	5. N	5. - (N)
6. N	6. T	6. T	6. T	6. - (N)
7. T	7. - (N)			7. T
8. T	8. T			8. - (T)
9. N				9. - (N)
				10. N
				11. T
				12. N
				13. T
				14. T

if the SOI is a reliable measure of teacher choice, we would expect the variances between the choices of one teacher to be smaller than the variance of choices made by different teachers. The formula proposed by Horst to compare these variances is:

$$r = 1 - \frac{\sum \frac{\sigma_i^2}{n_i - 1}}{\frac{N}{\sigma_M^2}}$$

where

r = An estimate of reliability of class means

N = The number of classrooms in the study

n_i = The number of indices obtained in each classroom (equal to the number of statements on the instrument)

σ_i^2 = The variance of the indices obtained in each classroom

σ_M^2 = The variance of the mean indices received in N classrooms

The reliability coefficients (r) obtained by this method were .57 for the SOI and .93 for the SPI. The reliability coefficients for each section of the SCAI were: .24 for section A, .61 for section B, .85 for section C, .96 for section D, and .008 for section E. These results indicate that the SOI and sections A and E of the SCAI lacked internal consistency. Where significant differences occurred on individual objectives on the SOI and individual statements in sections A and E of the SCAI, and where a pattern in group means is indicated, these differences are reported and discussed. Such reporting and discussion is not done for the SPI or for sections B, C and D of the SCAI.

In addition, determination was made of the consistency with which different students in a class perceived the behaviors listed on the SCAI as occurring on the part of the teacher. This was done by randomly selecting two

students from each of three classes participating in the study. The Percent of Agreement between students in a class was determined utilizing the following formula:

$$\% \text{ of Agreement} = \frac{\text{Number of statements on which students agree}}{\text{Number of statements on which they could agree}} \times 100$$

A mean Percent of Agreement for the three classes was then calculated. The mean values thus calculated for each section of the SCAI were: 71% for section A, 71% for section B, 67% for section C, 61% for section D, and 69% for section E. These values indicate a high degree of consistency between students in judging teacher behavior.

RESEARCH DESIGN

Questions and Null Hypotheses

This study attempted to answer the following questions:

1. Are PBTE trained science teachers more humanistic than non-PBTE trained teachers in the objectives they select for their classes?

2. Are PBTE trained science teachers more humanistic than non-PBTE trained teachers in the teaching behaviors and strategies they implement?

3. Are PBTE trained science teachers more humanistic than non-PBTE trained teachers in their assessment of students?

4. Do the students of PBTE trained science teachers perceive themselves as making more progress than do the students of non-PBTE trained teachers toward humanistic and nonhumanistic goals?

The following null hypotheses were established to answer these questions from the data gathered:

Hypothesis 1. There is no significant difference between the rank assigned to humanistic and nonhumanistic objectives on the SOI by science

teachers trained in a performance based teacher education program and those trained in a non-performance based program.

Hypothesis 2. There is no significant difference in perception of progress made toward essential and important objectives between students of science teachers trained in a PBTE program and students of teachers trained in a non-PBTE program.

Hypothesis 3. There is no significant difference in perceptions of teacher role between students of science teachers trained in PBTE programs and students of teachers trained in non-PBTE programs.

Hypothesis 4. There is no significant difference in perception of student participation in classroom activities between students of science teachers trained in a PBTE program and students of teachers trained in a non-PBTE program.

Hypothesis 5. There is no significant difference in perception of the use of texts and resources in the classroom between students of teachers trained in a PBTE program and students of teachers trained in a non-PBTE program.

Hypothesis 6. There is no significant difference in perceptions of evaluation and testing behaviors in the classroom between students of science teachers trained in a PBTE program and students of teachers trained in a non-PBTE program.

Hypothesis 7. There is no significant difference between perceptions of teacher's classroom behavior between students of science teachers trained in a PBTE program and students of teachers trained in a non-PBTE program.

PROCEDURES AND DATA COLLECTED

Administration

The administration of the GIQ and SOI was done in two ways, matching the ways in which the participant teachers were determined. For those teachers who had agreed by mail to participate, copies of the GIQ and SOI were mailed to them and were returned when completed. For those participants contacted in person, copies of the two instruments were left with them along with a return envelope. When completed, these forms were also returned.

Administration of the SPI and SCAI was done by a student chosen by the participating teachers. A standard set of instructions was included with each set of student response forms. These instructions included the sequence of instructions and the approximate dialogue to be followed. Each teacher was asked to have a student collect, package and seal the completed instruments to assure student candor.

Sequence of Instrument Administration

The GIQ and SOI were administered during the latter part of January and February, 1974. The SPI and SCAI were sent to the participating teachers on April 3, 1974, with instructions to administer it between the time of arrival and April 15. Due to mailing delays, some teachers did not administer the instruments until as late as April 25.

Data Collected

Personal data on the background, current teaching load and training program of each of the teachers was determined, in addition to information about the size of the college they attended.

For each of the goals listed on the SOI, a number--one for insignificant, two for important, and three for essential--was determined. This allowed a numerical analysis of the teacher preferences of goals.

The individual student responses to the twenty items on the SPI were

reduced to a single class average for each item.

Student responses on the SCAI were reduced to a class average by determining the number of students giving the correct response to that statement, and dividing that number by the total number of responses given to that item.

STATISTICAL ANALYSIS OF DATA

A one-way analysis of variance (ANOVA) was the standard statistical procedure used on all data obtained in this study.

Data from the SOI was analyzed according to twelve variables:

1. Amount of PSTE training the participating teacher had received
2. College where training took place
3. Age of the teacher
4. Sex of the teacher
5. Level at which the teacher taught--High School or Junior High
6. Subjects taught by the teacher
7. Teacher perception of the size of the student population at the training college
8. Teacher's perception of the number of science teachers certified during the year the participating teachers certified. Teacher's perception of the number of students was utilized for factors 7 and 8 instead of actual numbers, because it was felt, by the author, that factor 2 would include the effects of actual numbers in the student population and student teaching groups, and that teacher perception of how large or small these groups were might be important.
9. Organization of program--as modules, courses or a combination
10. Amount of conferencing the participating teacher had done with course instructors in the professional education sequence classes

11. Whether or not any training in human relations had been received by the participating teachers

12. The number of experiences in human relations training received

The SOI statements were grouped in three different ways during the analysis of these variables--as individual statements, as a combination of all humanistic goals, and as a combination of all nonhumanistic goals. Thus, thirty-three ANOVA's were performed on the SOI data.

Data from the SPI was treated in essentially the same manner as the SOI. In addition, however, a second set of thirty-three ANOVA's was performed on those statements regarded as essential and important by the participating teachers.

Data from the SCAI was analyzed according to the same eleven variables as the SOI and SPI. The data was grouped in two ways: first, each individual statement was analyzed; second, the data was analyzed according to the five sections found on the instrument.

CHAPTER IV

RESULTS

INTRODUCTION

As indicated earlier, the purpose of this study is to test the effect of Performance Based Teacher Education training on certain humanistic behaviors of selected science teachers. In addition, other selected factors which might have influenced these humanistic behaviors were studied. Analysis of variance of the collected data to test the effects of PBTE and the other factors was done utilizing the ANOVAR program of Veldman (54). The null hypotheses are rejected for any F-ratio whose value is equal to or greater than the value which would be obtained by chance 5% of the time.

ANALYSIS OF DATA FOR THE NULL HYPOTHESES

To study the influence of PBTE training, participating science teachers were grouped into five categories based on the amount of performance based instruction they had incurred throughout their entire sequence of professional education training. The five groups were: (1) No PBTE training in the professional education sequence; (2) 1-25% of the work in the professional education sequence was performance based; (3) 26-50% performance based; (4) 51-75% performance based; and (5) 76-100% performance based.

It had been originally planned by the researcher to classify the colleges or universities as having or not having performance based programs and to use that classification as the basis of analysis. Information provided by the participating teachers, however, indicated that individual courses at all schools might be performance based, even though the entire educational sequence was not. Therefore, the grouping indicated above was determined.

Only one teacher fell into group 1 and, hence, this category is not included in the analysis. All other teachers reported some performance based instruction, mainly in the student teaching experience.

Hypothesis 1. There is no significant difference between the rank assigned to humanistic and nonhumanistic objectives on the SOI by science teachers trained in a performance based teacher education program and those trained in a non-performance based program.

As shown in Table 2, probabilities of .22 and .49 were found for the F-ratios for humanistic and nonhumanistic SOI objectives obtained from a comparison of groups having different amounts of PBTE training. Since both of these probabilities are well above the .05 confidence level chosen, the null hypothesis cannot be rejected. Table 3 (see Appendix E) indicates that some significant differences among the groups on individual objectives did occur. Objective 2, concerning the ability of students to talk about the facts of science, has a probability value of .02. The significant difference most likely lies between groups 2 and 5. It will be noted that the group means show that increasing importance was given this objective as the amount of PBTE training increased. Means for objectives 8 and 16 show no pattern.

Hypothesis 2. There is no significant difference in perception of progress made toward essential and important objectives between students of science teachers trained in a PBTE program and students of teachers trained in a non-PBTE program.

The amount of PBTE training seems to have no effect on the amount of progress students perceive themselves as having made toward goals ranked as essential and important by their teacher. Table 2, showing probabilities of

T A B L E 2.--ANALYSIS OF VARIANCE SUMMARY--The effect of the amount of PBTE training on scores for humanistic and nonhumanistic SOI objectives and SPI objectives ranked as essential and important, and each section of the SCAI

Science Objectives Inventory

Objective	F-Ratio	P	Group Means 1-25% (N=12)	26-50% (N=24)	51-75% (N=11)	76-100% (N=8)
Humanistic	1.522	.22	1.84	2.03	2.07	1.97
Nonhumanistic	.818	.49	1.81	1.87	1.83	1.97

Student Progress Inventory

			(N=11)	(N=22)	(N=8)	(N=8)
Humanistic	1.835	.15	4.07	3.73	4.13	3.88
Nonhumanistic	1.573	.21	4.32	3.97	4.31	3.93

Science Classroom Activities Inventory

Section			(N=11)	(N=22)	(N=8)	(N=8)
A	.214	.89	70.60	70.46	70.97	67.68
B	.243	.87	50.55	52.38	49.49	50.28
C	4.591	.01	57.00	49.58	47.50	41.50
D	.548	.66	57.94	59.80	55.08	56.75
E	.093	.96	53.61	54.12	53.97	55.31

.15 and .21 for the humanistic and nonhumanistic objectives, respectively, clearly illustrates this lack of differentiation. Thus, the null hypothesis cannot be rejected.

Hypothesis 3. There is no significant difference in perceptions of teacher role between students of science teachers trained in PBTE programs and students of teachers trained in non-PBTE programs.

Section A of the SCAI deals with student perceptions of teacher role in the classroom. As indicated in Table 2, a probability value of .89 was determined for section A. Since this value is well above the .05 level of confidence previously determined, the null hypothesis cannot be rejected.

Hypothesis 4. There is no significant difference in perception of student participation in classroom activities between students of science teachers trained in a PBTE program and students of teachers trained in a non-PBTE program.

Section B of the SCAI is involved with student participation in classroom activities. Table 2 shows the probability value for section B to be .87, well above the .05 level of significance previously chosen. Therefore, the null hypothesis cannot be rejected.

Hypothesis 5. There is no significant difference in perception of the use of texts and resources in the classroom between students of science teachers trained in a PBTE program and students of teachers trained in a non-PBTE program.

Section C of the SCAI is concerned with the use of texts and resources in the classroom. Table 2 indicates the probability value for section C to be .01. Since this value is well below the .05 level of significance, the null hypothesis is rejected. As can be seen, the group means show a decrease with

increasing amounts of PBTE. Since these means represent the percentage of students seeing the desired (humanistic) behavior in their teachers, teachers with less than 25% PBTE were viewed as more humanistic by their students in the use of texts and resources than were teachers with more PBTE training.

Hypothesis 6. There is no significant difference in perceptions of evaluation and testing behaviors in the classroom between students of science teachers trained in a PBTE program and students of teachers trained in a non-PBTE program.

Section D deals with evaluation and testing behaviors of teachers in the classroom. Table 2 shows that a probability value of .66 was determined for section D. This value is well above the .05 level of confidence and, hence, the null hypothesis cannot be rejected.

Hypothesis 7. There is no significant difference between perceptions of teacher's classroom behavior in laboratory and classroom management between students of science teachers trained in a PBTE program and students of teachers trained in a non-PBTE program.

Section E of the SCAI is concerned with student perception of the teacher's classroom behavior in laboratory and classroom management. Table 2 indicates that section E has a probability value of .96, indicating nearly no measurable difference between groups. Since the probability is far above the .05 level of significance, the null hypothesis cannot be rejected.

ANALYSIS OF DATA FOR THE OTHER FACTORS

1. The Effect of the College Attended

Science teachers certified through the following six universities or

colleges were utilized in the study:

Weber State College (WSC)	Ball State University (BSU)
Brigham Young University (BYU)	University of Houston (UH)
Indiana State University (IU)	University of Texas at Austin (UT)

As indicated by Table 4, no significant differences were found between the teachers graduated from the several colleges in the rankings the teachers gave to humanistic and nonhumanistic objectives, or in the progress students saw themselves as having made toward objectives considered to be essential or important by the teachers.

Table 4 indicates further that no significant differences were found in student's perceptions of various classroom activites among teachers from different colleges. All sections of the SCAI show P-values above the .05 significance level. Five individual statements in section E show significant differences between groups, but only two display any pattern. Group means indicate that in statement E1, "My teacher tells us step by step what to do in the laboratory," and E7, "We are sometimes asked to design our own experiment to answer a question that puzzles us," students of teachers graduated at Indiana University and Weber State College were viewed as being more humanistic in their behaviors than teachers graduated from the other participating colleges.

2. The Effect of Teacher's Age

Teachers were grouped into three categories according to their age: Group (1) less than 25 years old; (2) 25-35 years old; and (3) over 35 years old.

Table 5 indicates no significant differences between groups for the ranks given humanistic and nonhumanistic objectives on the SOI by teachers, or for students' perceptions of the amount of progress made by them for

T A B L E 4.--ANALYSIS OF VARIANCE SUMMARY--The effect of the college attended on scores for humanistic and nonhumanistic SOI objectives and SPI objectives ranked as essential and important, and each section of the SCAI

Science Objectives Inventory

Objective	F-Ratio	P	Group Means					
			WSC (N=9)	BYU (N=10)	IU (N=13)	RSU (N=10)	UH (N=6)	UT (N=8)
Humanistic	.290	.92	2.42	2.43	2.48	2.41	2.56	2.33
Nonhumanistic	.925	.47	1.90	1.88	1.81	1.90	2.00	1.75

Student Progress Inventory

			(N=9)	(N=9)	(N=9)	(N=10)	(N=5)	(N=8)
Humanistic	1.016	.42	3.64	3.94	3.95	3.91	3.73	4.16
Nonhumanistic	1.142	.35	3.71	4.22	4.11	4.15	4.21	4.25

Science Classroom Activities Inventory

Section			(N=9)	(N=9)	(N=9)	(N=10)	(N=5)	(N=8)
A	1.141	.35	65.48	69.16	72.02	73.31	65.87	72.67
B	1.382	.25	48.29	55.33	49.78	52.19	48.78	55.02
C	1.644	.17	44.65	46.02	55.20	48.67	52.53	53.77
D	2.052	.09	52.07	55.78	63.09	60.05	63.47	56.25
E	2.212	.07	52.01	53.25	59.78	51.09	53.57	56.90

TABLE 5.--ANALYSIS OF VARIANCE SUMMARY--The effect of teacher's age on scores for humanistic and nonhumanistic SOI objectives and SPI objectives ranked as essential and important, and each section of the SCAI

Science Objectives Inventory

Objective	F-Ratio	P	Group Means		
			Less than 25 (N=27)	25 to 35 (N=27)	Over 35 (N=2)
Humanistic	.697	.51	1.95	2.03	2.09
Nonhumanistic	1.873	.16	1.84	1.91	1.61

Student Progress Inventory

			(N=25)	(N=23)	(N=2)
Humanistic	.234	.79	3.85	3.95	3.85
Nonhumanistic	.035	.97	4.10	4.09	4.21

Science Classroom Activities Inventory

Section			(N=25)	(N=23)	(N=2)
A	.719	.40	70.92	69.46	77.67
B	.571	.57	51.88	50.33	57.00
C	.645	.53	51.29	48.75	44.50
D	.539	.59	57.80	59.02	52.00
E	1.054	.36	53.98	54.22	61.43

objectives considered by the teacher to be essential or important. Likewise, Table 5 indicates no significant differences between groups for any section of the SCAI. It should be noted that group 3 consisted of only two participants.

3. The Effect of Teacher's Sex

A perusal of Table 6 shows no significant differences between men and women in the ranks they assigned to humanistic and nonhumanistic objectives, or in the progress their students saw themselves as having made toward objectives ranked as essential or important by the teacher.

No significant differences were found in students' perceptions of classroom activities between male and female teachers, as also shown on Table 6. All sections of the SCAI show P-values well above the established level of acceptance.

4. The Effect of the Grade Level Taught

As can be observed in Table 7, no significant differences were found between Junior High and Senior High School science teachers, either in the importance they assigned to humanistic and nonhumanistic objectives on the SOI, or in the students' perceptions of their progress toward objectives ranked as essential or important by their teachers.

No significant differences were found between Junior High and Senior High School teachers for any section of the SCAI, as indicated on Table 7. However, a large number of individual statements in sections A and E do show P-values below the .05 level of confidence as shown in Table 8 (see Appendix E). Group means for these data do not reveal any pattern. Students of Junior High School teachers gave a higher percentage of responses deemed to be humanistic for statements A2, E2, E7 and E9. Senior High students had a higher

T A B L E 6.--ANALYSIS OF VARIANCE SUMMARY--The effect of teacher's sex on scores for humanistic and nonhumanistic SOI objectives and SPI objectives ranked as essential and important, and each section of the SCAI

Science Objectives Inventory

Objective	F-Ratio	P	Group Means: Males (N=39)	Group Means: Females (N=17)
Humanistic	.025	.87	2.00	1.98
Nonhumanistic	.229	.64	1.85	1.89

Student Progress Inventory

			(N=34)	(N=16)
Humanistic	.177	.68	3.92	3.85
Nonhumanistic	.040	.84	4.11	4.08

Science Classroom Activities Inventory

Section			(N=34)	(N=16)
A	.052	.82	69.87	70.51
B	.310	.59	50.88	52.41
C	.088	.77	49.55	50.48
D	.128	.72	57.80	58.82
E	.595	.45	53.86	55.51

T A B L E 7.--ANALYSIS OF VARIANCE SUMMARY--The effect of the grade level taught on scores for humanistic and nonhumanistic SOI objectives and SPI objectives ranked as essential and important, and each section of the SCAI

Science Objectives Inventory

Objective	F-Ratio	P	Group Means	
			Junior High (N=29)	Senior High (N=27)
Humanistic	.436	.52	2.02	1.97
Nonhumanistic	.046	.82	1.86	1.87

Student Progress Inventory

			(N=27)	(N=23)
Humanistic	.636	.43	3.95	3.83
Nonhumanistic	.029	.86	4.11	4.08

Science Classroom Activities Inventory

Section			(N=27)	(N=23)
A	.442	.52	70.88	69.13
B	1.397	.24	49.98	53.00
C	.270	.61	49.15	50.67
D	.095	.76	58.51	57.68
E	.009	.92	54.30	54.49

percentage of responses viewed as humanistic for statements A5, A8, A9, E5, and E14 (see Appendix D for the statements).

5. The Effect of the Subjects Taught by the Teacher

Analysis of the effect of the subjects taught became somewhat complex because many teachers taught more than one subject. To conduct the analysis, therefore, all teachers who taught a given subject were compared against all teachers who did not teach that subject. Since only one teacher indicated he was currently teaching Physics, that subject was not included in the analysis.

As can be seen in Table 9, no significant differences were found among groups for the ranks teachers assigned to humanistic SOI objectives, or in the progress their students perceived themselves as having made toward objectives considered to be essential and important by the teacher.

Table 10, however, while indicating that no significant differences occurred among groups in the importance teachers lent to nonhumanistic objectives, shows that significant differences did occur between Physical Science and Biology teachers, and those teachers not teaching these subjects, in the progress students perceived themselves as having made toward objectives ranked as essential or important. The group means indicate that Physical Science students viewed themselves as making significantly less progress toward nonhumanistic objectives than other students, while Biology students viewed themselves as making significantly more progress than other students toward these same objectives.

As shown in Table 11 (see Appendix E) significant differences between Biology and Physical Science teachers, and teachers not teaching those subjects were found in connection with several objectives on the SOI and SPI. Biology teachers were found, in these instances, to rank objectives signifi-

T A B L E 9.--ANALYSIS OF VARIANCE SUMMARY--The effect of the subjects taught by the teacher on scores for humanistic SOI objectives and SPI objectives ranked as essential and important

Science Objectives Inventory

Subject	F-Ratio	P	Group Means: Teaching Subject	(N)	Not Teaching Subject	(N)
Life Science	.450	.51	2.04	(13)	1.98	(43)
Physical Science	1.091	.30	2.06	(14)	1.97	(42)
Earth Science	2.362	.13	2.17	(6)	1.97	(50)
General Science	.035	.85	1.98	(14)	2.00	(42)
Biology	.791	.38	1.95	(21)	2.02	(35)
Chemistry	.161	.69	2.06	(3)	1.99	(53)
Other Subjects	.394	.54	2.05	(9)	1.98	(47)

Student Progress Inventory

Life Science	.392	.54	3.98	(11)	3.87	(39)
Physical Science	1.821	.18	3.74	(14)	3.95	(36)
Earth Science	2.781	.10	3.58	(6)	3.94	(44)
General Science	.026	.87	3.92	(14)	3.89	(36)
Biology	2.539	.11	4.05	(18)	3.81	(32)
Chemistry	2.944	.09	3.41	(3)	3.93	(47)
Other Subjects	.010	.92	3.92	(7)	3.89	(43)

T A B L E 1 0.--ANALYSIS OF VARIANCE SUMMARY--The effect of the Subject taught by the teacher on scores for nonhumanistic SOI objectives and SPI objectives ranked as essential and important

Science Objectives Inventory

Subject	F-Ratio	P	Group Means: Teaching Subject	(N)	Not Teaching Subject	(N)
Life Science	.955	.33	1.92	(13)	1.85	(43)
Physical Science	2.010	.16	1.94	(14)	1.84	(42)
Earth Science	.413	.53	1.93	(6)	1.86	(50)
General Science	.019	.88	1.87	(14)	1.86	(42)
Biology	.886	.35	1.83	(21)	1.89	(35)
Chemistry	3.359	.07	2.11	(3)	1.85	(53)
Other Subjects	1.011	.32	1.79	(9)	1.88	(47)

Student Progress Inventory

Life Science	.709	.41	4.23	(11)	4.06	(39)
Physical Science	4.073	.05	3.85	(14)	4.20	(36)
Earth Science	.512	.48	3.94	(6)	4.12	(44)
General Science	.069	.79	4.07	(14)	4.11	(36)
Biology	3.876	.05	4.30	(18)	3.99	(32)
Chemistry	2.742	.10	3.59	(3)	4.13	(47)
Other Subjects	.504	.49	4.24	(7)	4.08	(43)

cantly lower than other teachers, but their students viewed themselves as making significantly more progress than other students. In contrast, Physical Science teachers ranked these specific objectives significantly higher than other teachers, but their students saw themselves as having made significantly less progress than other students.

Significant differences among groups of teachers teaching different subjects were found for several sections of the SCAI, as shown in Table 12. In section A, dealing with student perceptions of the role of the teacher in the classroom, Earth Science teachers were viewed as less humanistic than other teachers. In section D, concerned with testing and evaluative procedures in the classroom, Physical Science and Chemistry teachers were viewed as more humane, while Earth Science and Biology teachers were perceived as being less humane. In section E, dealing with teacher laboratory and classroom management behaviors, Life Science teachers were viewed as being less humanistic than other teachers.

A number of significant differences between groups on individual statements in sections A, D and E of the SCAI were found, as shown in Table 13 (see Appendix E). Life Science teachers were viewed as significantly less humanistic than other teachers on statements E1, E3, and E5 (see Appendix D for individual statements). Physical Science teachers were viewed by their students as being significantly less humanistic than other teachers on statements A5, A8, and A9, and significantly more humanistic on statement D2. Students of Earth Science teachers viewed their teachers as being significantly less humanistic on statements A4, A6 and D3. Biology students perceived their teachers as being significantly more humanistic for statements A4 and E10, but significantly less humanistic for statements A2, D2, E1 and E12.

T A B L E 1 2.--ANALYSIS OF VARIANCE SUMMARY--The effect of the subjects taught by the teacher on scores for each subject for each section of the SCAI

				Group Means			
Subject	Section	F-Ratio	P	Teaching Subject	(N)	Not Teaching Subject	(N)
Life Science	A	.533	.48	68.27	(11)	70.58	(39)
	B	1.222	.27	48.72		52.12	
	C	.269	.61	48.43		50.25	
	D	3.295	.07	53.71		59.37	
	E	3.915	.05	50.79		55.40	
Physical Science	A	1.993	.16	67.15	(14)	71.21	(36)
	B	1.739	.19	48.69		52.41	
	C	.703	.41	51.80		49.08	
	D	4.120	.05	62.29		56.51	
	E	.174	.68	53.71		54.65	
Earth Science	A	6.303	.01	61.65	(6)	71.22	(44)
	B	3.131	.08	45.38		52.19	
	C	.609	.45	46.78		50.27	
	D	7.450	.01	48.95		59.38	
	E	2.777	.10	49.98		54.99	
General Science	A	.721	.40	71.86	(14)	69.38	(36)
	B	.174	.68	52.23		51.04	
	C	.357	.56	48.45		50.38	
	D	.748	.40	59.97		57.41	
	E	.398	.54	55.40		53.99	
Biology	A	1.286	.26	72.04	(18)	68.97	(32)
	B	3.318	.07	53.15		49.66	
	C	1.297	.26	47.66		51.08	
	D	4.568	.04	54.49		60.17	
	E	.020	.88	54.20		54.49	
Chemistry	A	.248	.63	67.48	(3)	70.24	(47)
	B	.241	.63	53.88		51.21	
	C	.936	.34	55.39		49.49	
	D	17.932	.00	77.22		56.91	
	E	.537	.47	57.29		54.20	
Other Subjects	A	2.807	.10	48.48	(7)	44.49	(43)
	B	.666	.42	53.96		50.95	
	C	1.551	.22	54.29		49.12	
	D	1.731	.19	62.41		57.43	
	E	.768	.39	56.55		54.03	

6. The Effect of the Method in which Teacher Training Programs were Organized

Three methods of content and skill organization were tested: Courses, Modules, and a Combination of the two.

Table 14 illustrates that no significant differences were found among groups for the teacher rankings of humanistic and nonhumanistic objectives, or for the progress students of teachers in these groups saw themselves as having made toward objectives considered, by the teachers, to be essential or important.

Table 14 displays data from the analysis of each section of the SCAI. As can be seen, significant differences were found among groups for sections A, D and E, and that in all these instances, students of teachers trained in a completely modularized program gave fewer humanistic responses than other students. In addition, significant differences between groups were found for individual statements in these sections, as shown in Table 15 (see Appendix E). The same pattern found for sections A, D and E holds for all these individual statements, except for statement D2, where students of module-trained teachers had the highest percentage of humanistic responses.

It should be noted that only six participants were classified as having a completely modularized training program.

7. The Effect of Teacher's Perception of the Size of the Certifying College's Student Population

Teachers were organized into three categories, according to the size of their school population as they recalled it: Group (1) 5,000-10,000 students; (2) 10,000-20,000 students; and (3) over 20,000 students.

As indicated in Table 16, no significant differences between groups were found for the ranks teachers assigned to humanistic and nonhumanistic objectives, for the student's perceptions of the amount of progess they had

T A B L E 14.--ANALYSIS OF VARIANCE SUMMARY--The effect of the method in which teacher training programs were organized on scores for humanistic and nonhumanistic SOI objectives and SPI objectives ranked as essential and important, and each section of the SCAI

Science Objectives Inventory

Objective	F-Ratio	P	Group Means: Courses (N=34)	Modules (N=6)	Both (N=16)
Humanistic	.262	.77	1.97	2.02	2.03
Nonhumanistic	.565	.58	1.86	1.96	1.84

Student Progress Inventory

			(N=30)	(N=6)	(N=14)
Humanistic	1.022	.37	3.96	3.64	3.86
Nonhumanistic	2.383	.10	4.20	3.67	4.08

Science Classroom Activities Inventory

Section			(N=30)	(N=6)	(N=14)
A	4.748	.01	70.47	60.52	73.33
B	2.308	.11	56.64	44.21	51.71
C	2.195	.12	52.20	44.64	47.05
D	6.373	.00	61.44	49.92	54.55
E	3.102	.05	56.21	49.67	52.51

T A B L E 16.--ANALYSIS OF VARIANCE SUMMARY--The effect of teacher's perception of the size of the certifying college's student population on scores for humanistic and nonhumanistic SCI objectives and SPI objectives ranked as essential and important, and each section of the SCAI

Science Objectives Inventory

Objective	F-Ratio	P	Group Means		
			5,000-10,000 (N=7)	10,000-20,000 (N=15)	Over 20,000 (N=33)
Humanistic	.618	.55	2.06	1.93	2.01
Nonhumanistic	.117	.52	1.97	1.84	1.86

Student Progress Inventory

			(N=7)	(N=14)	(N=28)
Humanistic	1.008	.37	3.64	3.92	3.95
Nonhumanistic	1.802	.17	3.73	4.17	4.15

Science Classroom Activities Inventory

Section			(N=7)	(N=14)	(N=28)
A	.165	.85	68.59	69.54	70.68
B	.737	.49	49.27	50.80	52.73
C	1.122	.33	44.60	50.93	50.85
D	.394	.68	55.45	59.01	58.77
E	2.165	.12	52.17	51.93	56.18

made toward objectives deemed to be essential or important, or for the student's perception of factors in the classroom environment.

8. The Effect of Teacher's Perception of the Number of Teachers Certified by the College Attended

Participating teachers were organized into four groups for analysis of SOI, SPI and SCAI data in regard to this effect. The groups were: Group (1) less than 25 science teachers, (2) 25-50 science teachers, (3) 50-100 science teachers, and (4) over 100 science teachers.

Table 17 indicates that no significant differences were found between groups for the importance teachers lent to objectives on the SOI, but that a significant difference did exist between groups for the amount of progress students perceived themselves as having made toward humanistic objectives considered to be essential or important. Students of teachers in group 3 had the greatest progress, followed by groups 2, 4 and 1 in descending order. It should be noted as well that student perception of progress toward nonhumanistic objectives has a .06 probability and follows the same pattern.

A similar pattern can be seen in student perceptions of the classroom environment as expressed in the SCAI and shown in Table 17. Groups 3 and 4 have nearly equal means, both of which are larger than the means for groups 1 and 2. It appears that student perception of humaneness in the teacher increases with increased size of the student teaching group, peaking in the "50-100 science teachers" category.

9. The Effect of the Amount of Time Spent in Conference with Instructors

Participating teachers were organized into five groups to analyze the effect of this factor on SOI, SPI and SCAI data. The groups were designated as Group (1) No time ordinarily spent in conference with the instructor during

T A B L E 17.--ANALYSIS OF VARIANCE SUMMARY--The effect of teacher's perception of the number of teachers certified by the college attended on scores for humanistic and nonhumanistic SOI objectives and SPI objectives ranked as essential and important, and each section of the SCAI

Science Objectives Inventory

Objective	F-Ratio	P	Group Means			
			Less than 25 (N=12)	25-50 (N=10)	50-100 (N=8)	Over 100 (N=19)
Humanistic	.154	.93	1.98	2.07	2.02	2.01
Nonhumanistic	.169	.92	1.88	1.89	1.92	1.85

Student Progress Inventory

			(N=12)	(N=9)	(N=7)	(N=16)
Humanistic	2.887	.05	3.59	3.72	4.20	3.99
Nonhumanistic	2.672	.06	3.79	3.98	4.50	4.12

Science Classroom Activities Inventory

Section			(N=12)	(N=9)	(N=7)	(N=16)
A	2.916	.05	65.50	64.84	72.56	73.08
B	1.220	.31	48.62	48.28	55.50	52.27
C	.614	.61	47.25	49.52	53.12	47.44
D	1.036	.39	55.82	55.74	60.67	60.80
E	.749	.53	53.04	53.48	58.10	54.63

the course, (2) 1-2 hours ordinarily spent in conference with the instructor during the course, (3) 2-5 hours, (4) 5-10 hours, and (5) over 10 hours.

Table 18 indicates that no significant differences were found among groups for the teachers' rankings of humanistic and nonhumanistic objectives or student perception of progress recorded for objectives considered to be essential or important by their teachers.

Table 18 also indicates that significant differences among groups occurred in sections A and C of the SCAI. The only pattern observable is that group 5 had the lowest mean in both cases. It may be that the significantly lower means of group 5 are due to that group having only two participants in it.

10. The Effect of Human Relations Training

As illustrated in Table 19, no significant differences between groups were found for the ranks given by teachers to humanistic and nonhumanistic objectives, or the student progress reported, toward objectives ranked as essential or important by their teachers.

Student perceptions of the classroom environment as expressed on the SCAI, and shown in Table 19, also showed no significant differences between groups.

11. The Effect of the Number of Different Instructional Experiences During Human Relations Training

The teachers who had received some amount of human relations training were further subdivided by the number of different instructional experiences in which they had participated: Group (1) two types of experiences, (2) three experiences, (3) four experiences, (4) five experiences, and (5) six experiences.

As illustrated in Table 20, no significant differences among groups

T A B L E 1 8.--ANALYSIS OF VARIANCE SUMMARY--The effect of the amount of time spent in conference with instructors on scores for humanistic and non-humanistic SOI objectives and SPI objectives ranked as essential and important, and each section of the SCAI

Science Objectives Inventory

Objective	F-Ratio	P	Group Means: None (N=19)	1-2 Hours (N=20)	2-5 Hours (N=9)	5-10 Hours (N=5)	Over 10 Hours (N=2)
Humanistic	.687	.61	2.04	1.93	2.08	2.04	1.86
Nonhumanistic	.066	.99	1.87	1.86	1.85	1.89	1.94

Student Progress Inventory

			(N=18)	(N=18)	(N=8)	(N=3)	(N=2)
Humanistic	.492	.74	3.80	3.96	4.07	4.02	3.83
Nonhumanistic	.258	.90	4.05	4.16	4.25	4.09	3.95

Science Classroom Activities Inventory

Section			(N=18)	(N=18)	(N=8)	(N=3)	(N=2)
A	2.521	.05	69.61	68.65	76.43	71.48	55.94
B	.440	.78	52.38	50.85	50.99	54.63	44.38
C	2.552	.05	52.32	45.79	50.73	62.72	45.08
D	2.330	.07	62.97	55.29	55.98	60.22	50.58
E	2.007	.11	57.16	51.40	55.96	53.29	49.46

T A B L E 1 9.--ANALYSIS OF VARIANCE SUMMARY--The effect of human relations training on scores for humanistic and nonhumanistic SOI objectives and SPI objectives ranked as essential and important, and each section of the SCAI

Science Objectives Inventory

Objective	F-Ratio	P	Group Means None (N=22)	Group Means Some (N=34)
Humanistic	.017	.89	2.00	1.99
Nonhumanistic	1.477	.23	1.91	1.83

Student Progress Inventory

			(N=21)	(N=29)
Humanistic	1.415	.24	4.00	3.82
Nonhumanistic	1.517	.22	4.22	4.02

Science Classroom Activities Inventory

Section			(N=21)	(N=29)
A	.539	.47	71.20	69.26
B	.543	.47	52.48	50.57
C	.171	.68	50.56	49.33
D	1.574	.21	56.72	60.06
E	3.090	.08	52.93	56.40

T A B L E 2 0.--ANALYSIS OF VARIANCE SUMMARY--The effect of the number of different instructional experiences during human relations training on scores for humanistic and nonhumanistic SOI objectives and SPI objectives ranked as essential and important, and each section of the SCAI

Science Objectives Inventory

Objective	F-Ratio	P	Group Means				
			2 Exp. (N=3)	3 Exp. (N=3)	4 Exp. (N=2)	5 Exp. (N=4)	6 Exp. (N=22)
Humanistic	1.131	.36	1.97	1.94	1.68	1.86	2.05
Nonhumanistic	.246	.91	1.70	1.89	1.83	1.86	1.84

Student Progress Inventory

			(N=3)	(N=2)	(N=2)	(N=3)	(N=19)
Humanistic	.132	.97	3.72	3.77	4.06	3.77	3.83
Nonhumanistic	.846	.51	4.36	3.82	4.44	3.73	3.99

Science Classroom Activities Inventory

Section			(N=3)	(N=2)	(N=2)	(N=3)	(N=19)
A	.302	.87	66.81	68.72	72.89	64.22	70.11
B	1.322	.29	41.04	53.75	53.88	45.83	52.13
C	.582	.68	46.06	51.33	58.17	52.83	48.16
D	1.857	.15	52.78	70.33	61.83	48.72	56.64
E	2.415	.08	43.50	56.14	54.82	50.36	54.29

were found for the ranks teachers assigned humanistic or nonhumanistic SOI objectives, or the progress students made toward objectives deemed to be essential or important. In addition, no significant differences were found for any section of the SCAI, as shown in Table 20. Such a result is not unexpected in the face of the small N values for each group, and the results determined for factor 10.

SUMMARY

Analyses of variance were performed on the SOI, SPI and SCAI data. No significant differences were found among teachers for any of the twelve factors studied, in the ranks they assigned to humanistic and nonhumanistic objectives on the SOI. Likewise, no significant differences in the progress students felt they had made toward humanistic objectives which had been specified as essential or important by their teachers were found, except for the case where the effect of the number of teachers certified by the college attended was analyzed. For nonhumanistic objectives ranked as essential or important, the only instances of significant differences found were those involving a comparison of Biology and Physical Science teachers with those not teaching these subjects.

Section A of the SCAI showed significant differences among groups when a comparison of Earth Science teachers to other teachers was made, and when the factors of "Method of Program Organization," "Teacher's Perception of the Number of Teachers Certified," and "Amount of time Spent in Conference with Instructors" were considered.

Section C showed a significant difference among groups when the amount of PBTE training was considered and the effect of the amount of time spent in conference with instructors was analyzed.

Physical Science, Earth Science, Biology and Chemistry students viewed

their teachers as being significantly different than other teachers in regard to section D. Significant differences among groups for this section were also found when the method of program organization was studied.

The results for section E indicate Life Science teachers were viewed as being significantly different than other teachers for this section, and again, significant differences among groups were found for the effect of the method in which the teacher training program was organized.

Of notable interest in the results listed is that, in general, teachers ranked the humanistic objectives higher than nonhumanistic objectives, but students perceived themselves as having made greater progress toward nonhumanistic objectives.

The N values used in many of the analyses were so small that the meaning of the analyses for these cases cannot be clearly defined.

CHAPTER V

SUMMARY, CONCLUSIONS AND IMPLICATIONS

SUMMARY

The purpose of this study is to determine the effect of a program of performance based teacher education on selected humanistic behaviors of science teachers. Analysis of this effect was made using four instruments specifically designed for this study:

1. The General Information Questionnaire (GIQ)
2. The Science Objectives Inventory (SOI)
3. The Student Progress Inventory (SPI)
4. The Science Classroom Activities Inventory (SCAI)

Additionally, the influence of eleven factors, other than PBTE was studied and reported. These factors included: The school where certification was achieved, teacher's perception of the size of its student population and the number of science teachers it certified; the age and sex of the teacher, and the level and subjects which they taught; the amount of conferencing with instructors and the amount, if any, of human relations training they had received.

A panel of judges was utilized to determine validity of these instruments, resulting in interjudge reliability coefficients of .42 for the SOI and SPI, and .68 for the SCAI. These coefficients, though low, are still acceptable. Use of the reliability measure of Horst (31) resulted in reliability coefficients of .57 for the SOI, .93 for the SPI. Use of the same measure for each section of the SCAI resulted in reliability coefficients of .24 for section A, .61 for section B, .85 for section C, .96 for section D and .006 for section E. The low reliability for the SOI and sections A and E of the SCAI are indi-

cations of the lack of homogeneity in these instruments. Individual objectives or statements, showing significant differences, from instruments having low reliability were reported so as to determine any results which the lack of homogeneity might mask. The percent of agreement of randomly selected students on the SCAI was determined, resulting in mean values of 71% for section A, 71% for section B, 67% for section C, 61% for section D, and 69% for section E, which indicates a high degree of consistency in reporting teacher behavior.

Fifty-six science teachers and one class of students taught by each teacher participated in the study. The teachers had been certified by six different universities or colleges in three states.

Seven null hypotheses dealing with the effect of PBTE training on the types of objectives teachers set for their classes, the amount of progress their students saw themselves as having made, and the perceptions of students concerning the role of the teacher in the class, student participation in classroom activities, the use of texts and resources in class, teacher behavior in evaluation and testing of students, and teacher behavior in laboratory and classroom management were evaluated.

In addition, the effect of eleven other factors previously listed were evaluated.

CONCLUSIONS AND INFERENCES

It was found that no significant differences occurred among science teachers having different amounts of performance based training in the importance they lent to humanistic and nonhumanistic science objectives. All teachers, in general, indicated that humanistic objectives, those designed to increase the amount of student-student, student-teacher interaction, were more important in their classes than nonhumanistic objectives, those which stressed

non-interactive behaviors. Almost universally, teachers ranked the objective "Remember most of the factual material presented in the course," as being insignificant in their courses.

It was found that no significant differences occurred among science teachers having different amounts of PBTE training in the perceptions their students had of the amount of progress they had made toward objectives considered essential or important by their teachers. All students, in general, saw themselves as having made greater progress toward nonhumanistic, rather than humanistic objectives. Such a result is paradoxical in light of the emphasis on humanistic goals indicated by the teachers.

No significant differences were observed among students of teachers having different amountsof PBTE training concerning student perception of the role of the teacher in the classroom. The percentage of students giving responses deemedto be humanistic was greater for this section of the SCAI than for any other section, averaging nearly 70% for all groups. All teachers were, in general, viewed as humanistic in the role they assumed in the class.

Concerning the effect of PBTE on student perception of the amount of student participation which occurred in the classroom, no significant differences were found among groups of teachers with different amounts of PBTE training. Approximately 50% of the students in each group saw their teachers as involving students directly in classroom activities.

Significant differences were found among groups for the effect of PBTE on the teachers' use of texts and resources in the classroom. As the amount of PBTE training of teachers increased, the percentage of students giving the desired responses to statements concerning this effect decreased. Some difficulty in interpreting these results is presented by comments which several students completing the SPI and SCAI wrote on these instruments, indi-

cating that no textbooks were used in their classes. Since the assumption made in administering the instruments was that textbooks were used in all classrooms, the fact that no textbooks were utilized could have had the effect of inflating the number of humanistic responses given to statements in section C of the SCAI. Even in the light of the problem, the percentage of desired responses given by students ranges from approximately 40-57%, not a very high figure.

Students saw no significant differences among groups of teachers having different amounts of PBTE training in the behaviors the teachers exhibited in evaluation and testing. Approximately 56% of all responses given by students to section D of the SCAI viewed the teacher as humanistic in his behaviors involving this effect.

In the view of students, behavior in laboratories and classroom management procedures was nearly identical among teachers regardless of the amount of PBTE training the teachers had received. No significant differences were found among groups based on this factor. As with texts and resources, it was found that some students indicated they did not do any laboratory work. Such a fact would cause real problems in interpreting the meaning of results for this effect.

In evaluating the results of this study in terms of its purposes, two points of view might be expressed. First, it could be said that teachers trained in performance based programs are no more humanistic than those trained traditionally.

All teacher education programs seem to have, to some extent, components which are performance based. It may be that what is purported to be a new suit of clothes is, in fact, simply the result of a tailoring of the old suit. If the performance based segments try to accomplish what past programs

accomplished, only more definitively stated, then it would be natural to expect there to be no differences among them. This, then, would result in the charges leveled against past programs, concerning the humanistic behavior of the teachers they certified, being leveled in turn against performance based programs as well.

On the other side of the coin, it could be said that teachers trained in PBTE programs are no less humanistic than those trained traditionally. In this view, it would appear that the fears of opponents of PBTE are not realized. Teachers with a great deal of PBTE training were not viewed by students as being any more or less trivialized, or any more or less humane, than teachers with less PBTE training.

Both views are important to future development of PBTE programs. It is felt by the author, that, while the two training programs appear to be equal in their influence at present, the potential for improvement of the PBTE programs is greater. The opportunity provided in PBTE to specify what the training is to accomplish and to systematically evaluate that result improves the ability of the program to systematically add or delete objectives, or to recognize new tasks or abilities that should be incorporated into the program. This quality of systematic improvement of PBTE coupled with the results of research indicating that use of a behavioral approach has at worst, a neutral effect on students and may, in fact, result in very positive attitudes by students, does make it a strategy worthy of further examination and development. Such systematic evaluation and modification is not part of the fabric of non-PBTE programs. Developers of curricula, recognizing this potential, should utilize it to improve new and existing programs and rectify those problems which currently exist in teacher training programs. Use of PBTE to simply duplicate existing programs will then, by this process of evaluation,

addition and/or deletion, cease.

When the college attended, teacher's age, teacher's sex, the grade level taught, teacher perception of the size of the student population of the college attended, and the amount of human relations training the teachers had experienced were evaluated, no significant differences among groups were found in the rank teachers assigned to humanistic and nonhumanistic objectives, in student perception of the progress they made toward essential and important objectives, or in student perceptions of the role of the teacher in the class, student participation in class, the use of texts and resources by the teacher, teacher evaluation and testing behaviors, or teacher behavior in laboratory and classroom procedures.

In analysis of the effect of the subjects taught by the teachers, it was found that Biology students viewed themselves as having made significantly more progress than other students toward nonhumanistic goals considered to be essential or important, while Physical Science students viewed themselves as having made significantly less progress than other students toward these same objectives. No significant differences were found among groups for this effect for the rank teachers assigned to humanistic or nonhumanistic objectives, or for student perception of the progress they made toward humanistic objectives.

Life Science teachers were viewed by their students as significantly less humanistic than other teachers in their laboratory and classroom management behaviors. Physical Science students saw their teachers as being significantly more humanistic than other teachers in their evaluation and testing behaviors. Earth Science teachers were seen by their students as being significantly less humanistic than other teachers in the teacher's role in the classroom, and in evaluation and testing behaviors, Biology teachers were

found to be viewed as significantly less humanistic in their evaluation and testing behaviors than other teachers; whereas, Chemistry teachers were seen to be significantly more humanistic in the same behaviors.

The fact that several different teaching subjects had significant differences between groups for evaluation and testing behaviors warrants that further study be made of the factor. The other significant differences found seemisolated and may be due only to the makeup of the samples rather than to any problem inherent in training for or teaching a specific subject.

Teachers trained in a completely modularized program were found to be viewed by their students as significantly less humanistic than teachers trained in courses or a course-module combination in sections of the SCAI dealing with the role of the teacher in the classroom, evaluation and testing behaviors and in laboratory and classroom management procedures. Such a result may be due to the fact that only six teachers had been trained in a completely modularized program. That such a view was maintained in three separate areas of the SCAI indicates that further investigation of the effect of modularized instruction is necessary.

The teacher's perception of the number of science teachers certified by the college they attended was found to have a significant effect on the progress students perceived themselves as having made toward humanistic objectives, and a nearly significant effect on progress toward nonhumanistic objectives. As the size of the certified group increases in the teacher's recollection, student perception of progress increases, with a peak occurring in the "50-100 science teachers" category.

The inferences drawn from the results concerning the other factors studied are as important to this study as the inferences drawn from the effects of PBTE. It appears that the humanistic behaviors of science teachers are

little influenced by their training program. All teachers generally rated humanistic goals as being very important in their courses, and nonhumanistic goals of less import, regardless of differences in college characteristics, training program or teaching load of the teachers. The education of teachers, then, is at least resulting in teachers who are equally idealistic in their attitudes toward the interactions they wish to develop with their students. Whether or not these idealisms become reality is another question. The amount of reality achieved appears to be equal among all teachers. All teacher education programs, then, are equally good or equally bad, depending on your point of view, in causing teachers to behave humanistically. With this seemingly universal equity, it might be asked whether it is the teacher training programs--which to say the least are divergent in the emphases they seem to place--or some other part of the collegiate experience which causes these attitudes to develop on the part of new teachers. Such a question must be left for other researchers.

It may also be that the results concerning the factors other than PBTE are simply a reflection of the instruments used. The low validity and reliability may be an indication that the effects under study were not being adequately measured by these instruments. This in turn indicates that differences between groups may exist, but were not measured. Future research efforts may clarify this question.

LIMITATIONS

The generalizability of these results is limited by the following factors:

1. The small N number of the samples in some instances.

2. The low degree of validity and reliability for the instruments developed. The circumstances of this study, including the small number of

graduates from colleges having completed PBTE programs, precluded attempting a pilot study with the instruments. Future studies, as more PBTE teachers enter the field, will provide opportunity to clarify and improve the instruments.

IMPLICATIONS AND RECOMMENDATIONS

The difficulties in identifying and locating the sample for this study indicate the low priority which is placed on career-long observation of teachers certified by an institution of higher learning. Recognizing the administrative and financial difficulties of keeping track of a large and perpetually increasing list of graduates, it is nonetheless recommended that such a practice be instituted by all colleges implementing PBTE programs. The feedback necessary to utilize the latent power of PBTE cannot occur if such a practice remains uninstituted.

In addition, it can be recommended to future researchers in this area that, where practical, the practice of personal contact with potential participants proved highly satisfactory in securing their help. Such personal contact will require that good relations be developed and maintained with administrators in local school districts. Colleges implementing PBTE would do well, in the interest of career-long study of teachers, to begin the development of these relationships with the decision to use the PBTE approach.

Further work is necessary in developing and perfecting the instruments used in this study. It would be useful for future researchers to expand the list of objectives on the SOI or to develop a bank of objectives that could be rated by teachers. Also, development of the SCAI to fit the variety of classroom conditions now present throughout the country and to prevent the introduction of a bias in its administration due to the lack of textbooks,

laboratories or some other aspect of classroom environment is necessary.

Many questions were raised and stated during the execution of this study, which deserve further examination, to which the following can be added:

1. Why do nearly 70% of the teachers certified in science not teach in that field? What implications does this lend to preservice and inservice teacher education?

2. Would classroom observation of the teachers by a trained observer verify students' opinions of what the teacher does in the classroom?

3. Does instruction by courses create more humanistic behaviors in teachers than instruction by modules? And if so, why?

4. To what extent is follow-up instruction in an inservice program necessary to help teachers apply the techniques and attitudes taught in the professional education sequence?

5. What relationships exist between current non-PBTE and PBTE programs in the objectives they stress?

That the implementation of PBTE programs is increasing throughout the United States is an obvious fact. That it holds promise for improvement of current teacher training practices is less readily admitted to by some, though such potential, in the author's view, can be recognized. To build upon the current level of interaction which new teachers have with their students, and to devise improved training programs to raise these levels is the goal of all educators. It is felt by the author that the design developed in this study will provide a basis for this ongoing development and improvement.

APPENDIX A

THE UNIVERSITY OF TEXAS AT AUSTIN

Science Education Center

QUESTIONNAIRE

A. Name_____

B. Basic Information

Instructions: For questions 1-3, place an X in the categories that best describe you or your experience. For question 4, please fill in the information requested.

1. Age less than 25___ 25-35___ 36-45___ over 45___

2. Sex Male___ Female___

3. Subjects and levels you are presently teaching Jr. High___ Sr. High___

Life Science___ General Science___ Chemistry___

Physical Science___ Biology___ Other (list)_____

Earth Science___ Physics___ _____

4. University or college where you earned your teaching certificate

_____

C. Information on the Program of Instruction in Education of the College Where You Earned Your Teaching Certificate

Instructions: For questions 1-3, place an X in the category that best describes your certifying college. By "modules" is meant a complete, self-contained set of learning and evaluation experiences intended to facilitate the students attainment of a stated set of objectives.

1. How was the education instruction at your college organized?

Courses___ Modules___ Both___

2. How large was the student population of the university at the time you certified?

less than 5,000___ 5-10,000___ 10-20,000___ over 20,000___

3. Approximately how many science teachers were certified the year you certified?

less than 25___ 25-50___ 50-100___ over 100___

Instructions: The topics listed below are often included in teacher education programs. In your program, they may have been included

in a course, a module, a portion of a course or module, or not at all. For each of the following questions, list the letters of the topics that best represent the emphasis given in your program. For example, in question 4, if your program consisted of 8 instructional hours each of Basic Teaching Methods and Education Psychology, and 30 instructional hours of Student Teaching, they would be listed thus:

None	1-10 hours	11-20 hours	over 20 hours
c,d,e,f,g	a,b		h

The hours mentioned in the several questions below refer to clock hours, NOT semester or quarter hours. By human relations training is meant an organized program of training in the theories of human psychology, experience in the recognition of these theoretical activities in humans, and practice in applying these theories to classroom situations. See question 8 for examples of activities.

Topic Areas

a. Basic Teaching Methods
b. Science Teaching Methods
c. Educational Psychology
d. History and/or Philosophy of Education
e. Human Relations Training
f. History and/or Philosophy of Science
g. Observation in the Schools
h. Student Teaching

4. Approximately how many hours of instruction were given in each of the topic areas, or if modularized, how many hours did it take to complete the module?

None 1-10 hours 11-20 hours over 20 hours

5. What percentage of each of the topic areas was taught on a competency basis? By competency basis is meant that the objectives were outlined in advance, and successful completion of the topic required some observable method of displaying that the competency had been developed. Such displaying usually will incorporate examination methods in addition to, or in place of, tests of content recall.

None 1-25% 26-50% 51-75% 76-100%

6. How much time was spent in individual conferences with the instructor during the semester in each of the topic areas?

None 1-2 hours 2-5 hours 5-10 hours over 10 hours

7. Which of the topics were taught in the education department, which in science, and which in other departments?

Education	Science	Other

8. If human relations training was included in your instructional program, how much instructional time was spent in each of the following types of experiences? Put an X under the appropriate category. The total should not exceed the number of hours indicated in question 4.

	0-5 hrs	5-10 hrs	10-20 hrs	over 20 hrs
Observation				
Classroom Discussions				
Sensitivity or Encounter Sessions				
Lectures				
Outside Speakers				
Media				

APPENDIX B

THE UNIVERSITY OF TEXAS AT AUSTIN

Science Education Center

SCIENCE OBJECTIVES INVENTORY

Instructions: Each of the following statements is a possible objective for students in science classes. Some may have been important in your classes, while others were not important. Please indicate, by placing an X in the appropriate category, whether you would consider each of these objectives to be essential, important or insignificant for your students to have accomplished this year.

	Insignificant	Important	Essential
1. Better understand oneself through application of one's knowledge of science	___	___	___
2. Carry on conversation concerning a majority of the factual material presented in the course	___	___	___
3. Think or act like a scientist when faced with problems in one's own life	___	___	___
4. Remember most of the factual material presented in the course	___	___	___
5. Participate in discussions on current science issues, utilizing knowledge of the general principles of science involved in the issue	___	___	___
6. List or recite examples of how professional scientists think or act	___	___	___
7. Recognize the facts presented in the course when they are included in articles on science in commonly read magazines and newspapers	___	___	___
8. Work with others to apply the facts and principles of science to possible solutions of current issues and problems	___	___	___
9. Better understand others through application of one's knowledge of science	___	___	___
10. Be able to recognize or list the major principles of science presented in the course	___	___	___

	Insignificant	Important	Essential
11. Recognize the general principles of science in the texts of magazine and newspaper articles on current issues involving science	____	____	____
12. Write science essays or reports	____	____	____
13. Use science to plan the improvement of one's own life	____	____	____
14. Recognize examples of science as part of our culture	____	____	____
15. Think or act like a scientist while participating as part of a group in studying some problem	____	____	____
16. Teach or explain a topic in science to someone else	____	____	____
17. Work with others in using science to plan the improvement of the group's life activities	____	____	____
18. Organize or influence others to determine the role of science in causing or affecting current cultural conditions	____	____	____
19. Cause a group in which one is participating to think or act scientifically in studying some problem	____	____	____
20. Present oral reports on a scientific topic to a group	____	____	____

APPENDIX C

THE UNIVERSITY OF TEXAS AT AUSTIN

Science Education Center

STUDENT PROGRESS INVENTORY

Instructions: The purpose of this questionnaire is to determine how much improvement you feel you have made in your science class. Each of the following statements ask about your progress toward some possible goals for science classes. Some of these goals may have been important in your class while others were not important. This list, therefore, is not a test, and is not designed to grade either you or your teacher.

You are to read each statement and decide how much you have improved in that task DURING THE TIME YOU HAVE BEEN IN THIS SCIENCE CLASS. After deciding, circle the number on the scale next to the statement to show your decision. A "1" means you have not improved at all; a "7" means you have improved greatly. REMEMBER: you are to determine how much better you are now at doing the task than when you first started this science class.

SAMPLE QUESTION

	No Change						Greatly Improved
1. Are you any better at copying down assignments from the board?	1	2	3	4	5	6	7

SCIENCE GOALS

	No Change						Greatly Improved
1. Are you better at using your knowledge of science to learn about yourself?	1	2	3	4	5	6	7
2. Have you improved in your ability to talk with other people about the facts you have learned in science?	1	2	3	4	5	6	7
3. Do you have more ability to think and act like a scientist when you have a problem of your own to solve?	1	2	3	4	5	6	7
4. Are you better able to remember most of the facts taught in your science class?	1	2	3	4	5	6	7
5. Are you better at talking with others about current events happening in science, and	1	2	3	4	5	6	7

	No Change						Greatly Improved
using the ideas you learned in science to explain your ideas?							
6. Is it easier to make a list of how scientists think and act?	1	2	3	4	5	6	7
7. Is it easier now to recognize science facts being talked about in newspaper or magazine articles?	1	2	3	4	5	6	7
8. Have you improved in your ability to work with others to use what you have learned about science to try to solve problems?	1	2	3	4	5	6	7
9. Are you more able to use what you have learned about science to understand yourself better?	1	2	3	4	5	6	7
10. Are you better at remembering the major ideas you were taught in science?	1	2	3	4	5	6	7
11. Have you improved in your ability to recognize ideas being talked about in newspaper or magazine articles?	1	2	3	4	5	6	7
12. Is it easier to write essays or reports on science?	1	2	3	4	5	6	7
13. Do you have more ability to use what you have learned about science to plan ways to improve yourself?	1	2	3	4	5	6	7
14. Do you have more ability to recognize examples of science in the things you and other people do each day?	1	2	3	4	5	6	7
15. Have you improved in your ability to think or act like a scientist when you are working with a group on a problem?	1	2	3	4	5	6	7
16. Are you better at teaching or explaining a topic in science to someone else?	1	2	3	4	5	6	7
17. Are you better able to use what you have learned about science to work with others to plan how to improve the way you all live?	1	2	3	4	5	6	7
18. Are you better at helping others to see how science works in the things they do everyday?	1	2	3	4	5	6	7

	No Change						Greatly Improved
19. Have you improved in your ability to be a leader and cause others you are working with to think or act like scientists?	1	2	3	4	5	6	7
20. Is it easier to present reports on science in front of a group?	1	2	3	4	5	6	7

APPENDIX D

THE UNIVERSITY OF TEXAS AT AUSTIN

Science Education Center

SCIENCE CLASSROOM ACTIVITIES INVENTORY

Instructions: The purpose of this questionnaire is to determine how well you know what is going on in your science class. Each statement describes some classroom activity. The activities are not being judged as being good or bad. Therefore, this is not a test and is not designed to grade either you or your teacher. As you complete the questionnaire, please place all marks in the space to the left of the statement you are answering.

SAMPLE QUESTION

___ 1. My teacher often takes class attendance.

If the statement above describes what occurs in your classroom, write a T (True) in the space to the left of the number; if the statement does not describe what occurs, write an N (for Not True) in the space. Do the same for all of the following statements.

REMEMBER: Write a T if the statement is true and an N if the statement is not true for your science class.

Section A

___ 1. My teacher often asks us to explain the meaning of certain things in the textbook.

___ 2. Much of our class time is spent in listening to our teacher tell us about the science topic we are studying.

___ 3. My teacher asks questions that cause us to think about how science affects things we have learned in other classes.

___ 4. We don't often discuss in class how we feel about things other than science.

___ 5. My teacher doesn't mind admitting his or her mistakes.

___ 6. We usually don't get to work with other people in class.

___ 7. My teacher often asks questions that cause us to think about the evidence that is behind statements that are made in the textbook.

___ 8. Everybody usually gets a chance to say what they think about the topic we are discussing.

___ 9. My teacher is usually too busy to help me with things that the rest of the class understands, but I don't.

Section B

___ 1. My job is to copy down what the teacher tells us.

___ 2. We students are often allowed time in class to talk among ourselves about ideas in science.

___ 3. Much of our class time is spent in answering questions that are written in our textbooks or on our study guides.

___ 4. Classroom demonstrations are usually done by students rather than by the teacher.

___ 5. We seldom or never discuss the problems faced by scientists in the discovery of a scientific principle.

___ 6. If I don't agree with what my teacher says, he wants me to say so.

___ 7. Most of the questions in class are to clear up what the teacher or the textbook has told us.

___ 8. We often talk in class about the kind of evidence that is behind a scientist's conclusion.

Section C

___ 1. When reading the textbook, we are expected to learn most of the details stated there.

___ 2. When reading the textbook, we are always expected to look for the main problems and for the evidence that supports them.

___ 3. We are frequently required to write out definitions to word lists.

___ 4. Our teacher tried to teach us how to ask questions of the textbook.

___ 5. We generally are required to outline sections of the textbook.

___ 6. We are encouraged to bring in newspaper articles and other materials on science to share with the class.

Section D

___ 1. Our tests often ask us to write out or choose correct definitions of scientific words.

___ 2. Our tests often ask us to figure out answers to new problems.

___ 3. Our tests often ask us to put labels on drawings.

___ 4. My teacher wants us to talk to him if we think we should get credit for an answer he marked wrong on a test.

___ 5. My teacher is not willing to explain why he thinks one answer is better than another on the test questions.

___ 6. The grades I have received on tests in science give a good picture of the amount of work I do in science.

Section E

___ 1. My teacher usually tells us step by step what we are to do in the laboratory.

___ 2. We often use the laboratory to investigate a problem that comes up in class.

___ 3. The laboratory usually comes before we talk about that topic in class.

___ 4. We usually know the answer to a laboratory problem that we are investigating before we begin the experiment.

___ 5. Many experiments that are done in the laboratory are done by the teacher or other students while the class watches.

___ 6. Our teacher is often busy grading papers or doing some other personal work while we are working in the laboratory.

___ 7. We are sometimes asked to design our own experiment to answer a question that puzzles us.

___ 8. The teacher answers most of the questions about the laboratory work by asking us questions.

___ 9. We spend less than one-fourth of our time in science doing laboratory work.

___ 10. We rarely talk during class about what we have observed in the laboratory.

___ 11. After every laboratory session, we compare the data we have collected with the data of other individuals or groups.

___ 12. Our teacher often grades our data books for neatness.

___ 13. Our class is able to explain all unusual data that are collected in the laboratory.

___ 14. We are fairly free to move around the classroom during laboratory sessions.

APPENDIX E

TABLE 3.--ANALYSIS OF VARIANCE SUMMARY--The effect of the amount of PRTE training on scores for SCI objectives 2, 8 and 16

Objective	F-Ratio	P	Group Means			
			2 (N=12)	3 (N=24)	4 (N=11)	5 (N=8)
2	3.567	.02	1.25	1.79	2.00	2.13
8	3.351	.03	1.92	2.50	2.45	2.50
16 . . .	4.156	.01	1.75	1.88	2.36	1.63

T A B L E 8.--ANALYSIS OF VARIANCE SUMMARY--The effect of the grade taught on scores for SCAI statements in sections A and E, showing a significant difference between groups

Statement	F-Ratio	P	Group Means	
			Junior High (N=27)	Senior High (N=23)
A 2	14.523	.00	57.96	27.15
A 5	5.286	.02	80.11	90.09
A 8	4.072	.05	72.78	82.61
A 9	5.739	.02	82.04	90.57
E 2	4.668	.03	37.54	25.61
E 5	4.062	.05	64.56	77.74
E 7	20.183	.00	46.63	23.05
E 9	8.705	.01	55.41	34.83
E14	10.923	.00	65.07	84.52

T A B L E 11.--ANALYSIS OF VARIANCE SUMMARY--The effect of the subjects taught by the teacher on scores for SOI objectives and SPI objectives ranked as essential and important, showing significant differences between groups

Science Objectives Inventory

Objective	Subject	F-Ratio	P	Group Means: Teaching Subject	(N)	Not Teaching Subject	(N)
3	Biology	3.758	.05	1.71	(21)	2.06	(35)
5	Physical Science	3.891	.05	2.36	(14)	2.02	(42)
7	Physical Science	6.507	.01	2.57	(14)	2.12	(42)
11	Physical Science	4.187	.04	2.43	(14)	2.10	(42)
11	Biology	3.821	.05	2.00	(21)	2.29	(35)
17	Physical Science	4.932	.03	2.21	(14)	1.81	(42)
19	Biology	4.130	.04	1.71	(21)	2.06	(35)

Student Progress Inventory

1	Physical Science	5.440	.02	3.46	(14)	3.98	(36)
1	Biology	16.169	.00	4.32	(18)	3.55	(32)
2	Biology	4.061	.05	4.47	(18)	3.98	(32)
9	Physical Science	6.258	.02	3.50	(14)	4.09	(36)
9	Biology	5.662	.02	4.26	(18)	3.73	(32)
10	Physical Science	4.323	.04	4.23	(14)	4.72	(36)
16	Biology	3.850	.05	4.17	(18)	3.85	(32)

T A B L E 13.--ANALYSIS OF VARIANCE SUMMARY--The effect of the subjects taught by the teacher on scores for SCAI statements in section A, D and E, showing a significant difference between groups

Statement	Subject	F-Ratio	P	Group Means: Teaching Subject	(N)	Not Teaching Subject	(N)
A 2	General Science	5.121	.03	60.75	(14)	38.27	(36)
A 2	Biology	4.176	.04	32.06	(18)	51.00	(32)
A 4	Earth Science	4.566	.04	40.67	(6)	54.82	(44)
A 4	Biology	8.721	.01	61.28	(18)	48.53	(32)
A 5	Physical Science	6.310	.01	76.07	(14)	88.06	(36)
A 6	Earth Science	7.545	.01	69.17	(6)	88.64	(44)
A 7	Other Subjects	3.875	.05	87.29	(7)	75.71	(43)
A 8	Physical Science	5.705	.02	68.14	(14)	80.86	(36)
A 9	Physical Science	6.738	.01	78.64	(14)	88.81	(36)
D 2	Physical Science	21.292	.00	61.57	(14)	37.64	(36)
D 2	Biology	5.095	.03	36.33	(18)	48.84	(32)
D 3	Earth Science	9.945	.00	12.17	(6)	47.84	(44)
E 1	Life Science	4.720	.03	19.20	(11)	38.38	(39)
E 1	General Science	4.920	.03	47.23	(14)	29.35	(36)
E 1	Biology	6.333	.01	22.41	(18)	41.03	(32)
E 3	Life Science	3.862	.05	17.73	(11)	27.89	(39)
E 5	Life Science	4.109	.05	58.18	(11)	74.13	(39)
E10	Biology	3.837	.05	76.28	(18)	67.37	(32)
E12	Biology	4.666	.03	50.11	(18)	66.66	(32)

T A B L E 15.--ANALYSIS OF VARIANCE SUMMARY--The effect of the method in which teacher training programs were organized on scores for SCAI statements in sections A, D and E, showing significant differences among groups

Statement	F-Ratio	P	Group Means		
			Courses (N=30)	Modules (N=6)	Both (N=14)
A 5	6.090	.00	87.07	65.03	87.93
A 8	6.725	.00	79.83	55.00	81.43
A 9	15.143	.00	88.03	64.17	90.86
D 2	3.148	.05	47.90	51.17	33.79
D 4	8.618	.00	90.07	70.67	86.50
D 5	13.287	.00	88.03	66.00	86.00
E14	3.350	.04	79.60	55.83	69.86

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